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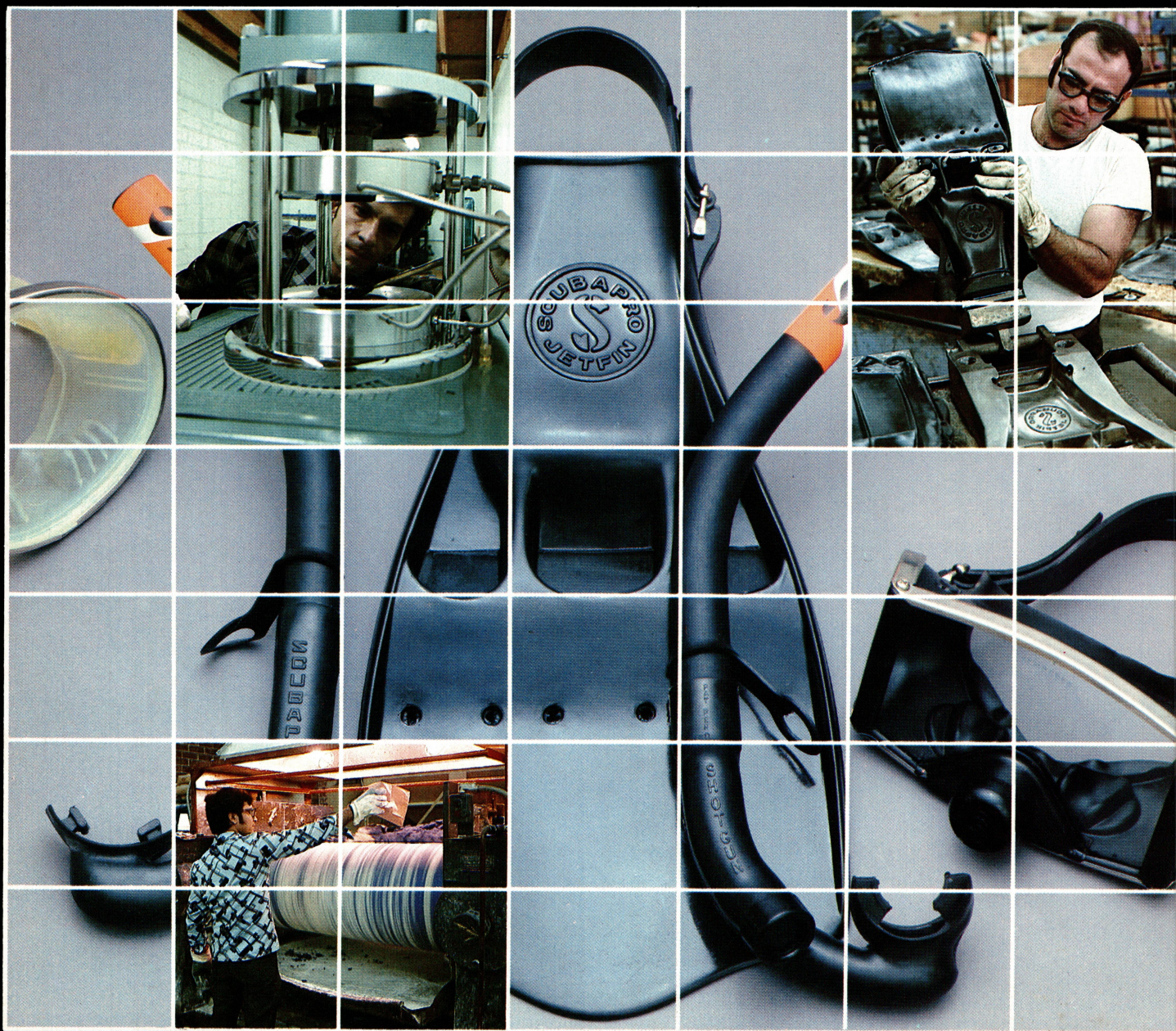
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# skin diver

Volume Thirty Number Three

PHOTOGRAPHY	8	<b>FORCE THE PERSPECTIVE</b>	JIM AND CATHY CHURCH	Use a wide-angle lens for emphasis
CONSERVATION	16	<b>BLOODBATH AT IKI</b>	HOWARD HALL	Men and dolphins in an ancient struggle
LOCAL DIVING	24	<b>CALIFORNIA KELP FORESTS</b>	MARTY SNYDERMAN	A magnificent refuge for nature and man
ADVENTURE	33	<b>THE ABC'S OF THE DUTCH CARIBBEAN</b>	PAUL J. TZIMOULIS	SDM looks at Aruba, Bonaire and Curacao
DIVE EQUIPMENT	49	<b>SUBMERSIBLE PRESSURE GAUGES</b>	GEORGE COZENS	A roundup of 19 SPG's
	60	<b>THE BOTTOM LIGHT</b>	GERI MURPHY	A mini dive light with some clever features
	62	<b>THE PARKWAY STORY</b>	BILL GLEASON	Innovation and quality over the years
FOREIGN TRAVEL	68	<b>MANIHI</b>	BOB AND NANCY FRENCH	South seas fantasy island
DEPARTMENTS	12	<b>DIVER'S CALENDAR</b>	65	<b>TRAVEL PAGE</b>
	20	<b>FILM FESTIVALS</b>	82	<b>RX FOR DIVERS</b>
		<b>AND SYMPOSIUMS</b>	84	<b>NEW GEAR</b>
	59	<b>TECHNIFACTS</b>		
			89	<b>SCUBA QUIZ</b>
			92	<b>FISH OF THE MONTH</b>
			100	<b>DIVER'S DIRECTORY</b>

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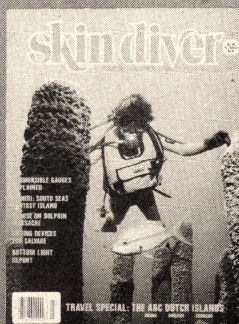
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## COVER

*Dive Bonaire divemaster, Dee Scarr, discovers a friendly yellowtail snapper among the pillars of a tube sponge near Klein Bonaire. Geri Murphy used a Nikonos III, with 15mm lens, Oceanic 2001 strobe.*

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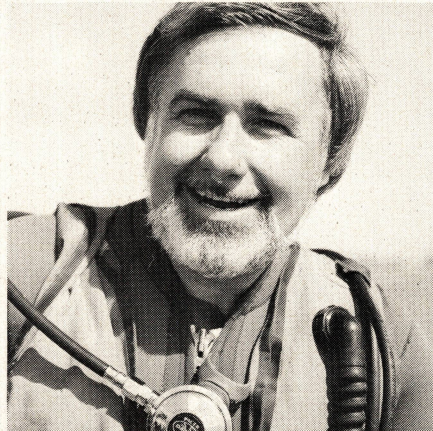


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# SDM Editorial

## BY THE PUBLISHER



### BUILDING YOUR INNER STRENGTH

**S**urvival underwater can often depend on your personal strength. This is why scuba instructors stress the need for physical fitness. New dive students are encouraged to swim laps, exercise regularly and build up their stamina. Their ultimate goal is to improve circulation, increase respiratory efficiency and strengthen the body muscles for handling scuba gear.

While diving is generally a pleasant and relatively easy outdoor activity, there are those unexpected moments when strength is needed. Ocean currents can quicken without warning; surf can grow into towering mountains of cascading water; surface conditions can change from flat calm to heavy chop in minutes. It is times like these that require an extra burst of energy.

In addition to building up the body, there is another kind of strength which every diver must develop — *inner strength*. This is difficult to define, but can be best described as an ability to remain calm and confident in the face of imminent calamity. It is the strength that comes from the mind — a firm resolve that you can handle any emergency situation short of a tidal wave. And yet, inner strength is more than just self-confidence. It is the ability to solve emergency problems quickly and precisely. There is a big difference between *thinking* you can handle an emergency and *knowing* you can handle it.

Why is this inner strength so important? Because it is the single most important weapon in the fight against fear and panic. No matter how strong you may be, or how many miles you jog every morning, physical strength alone cannot solve dive emergencies. We have seen weight lifters and football heroes get into just as much trouble underwater as Mr. Milktoast. It is confusion and uncertainty which often lead to a panic situation: Div-

ers must learn to effectively resist the urge to panic. Mind control is the key.

No one is born with inner strength — it must be developed through training, practice and experience. While it may come easier to some, everyone can learn it by following this simple three step formula for self-reliance development:

The basic building block of inner strength is **knowledge**. One must fully understand the dynamics of the underwater world in order to be completely at ease in this environment. Divers need to develop the ability to work in harmony with the sea instead of trying to fight it. It is far easier to ride with the current than swim against it.

Unfortunately, a basic scuba class is not enough. It is merely an introduction to diving — a mere beginning. It barely scratches the surface of the vast storehouse of knowledge a diver must learn in order to be fully competent. A basic scuba course should be the beginning of a continuous education program rather than the end of it.

There are a variety of ways to continue your dive education after basic class. You may choose a self-education program by reading books and periodicals which offer information on advanced diving techniques. Such books as *Diving Free, Easy Diver*, Volume II of the *Jepesen Sport Diver Manual*, *PADI Advanced Dive Manual* and *Sport Diving A to Z* provide helpful information for improving and expanding your dive technique. Supplemental texts on seamanship, emergency first aid and marine biology are also very helpful.

Perhaps the fastest and best way to gain diving knowledge is to enroll in an advanced diving course. Here you will discover a wealth of information and have a great deal more fun while learning. Advanced diving courses have become immensely popular in the past two

years and some research experts credit this educational trend for the reduction in annual sport diving fatalities.

The second step in developing inner strength is **practice**. Learning from books is not enough. Diving is not a theoretical pursuit but rather a struggle for survival in an alien environment. A diver must practice what he or she has learned. This could mean making a half-mile swim while towing your scuba gear; inflating your BC jacket on the surface a few times just to get the feel of it; or making an emergency swimming ascent from 30 feet to experience the real thing. Part of knowing what to do in a real emergency is having practiced the same routine in a non-emergency situation. One of the reasons advanced dive courses have been so successful is that they emphasize open water training under realistic conditions.

The third building block for inner strength is **experience**. This is one of the reasons inner strength cannot be acquired overnight nor purchased for any amount of money. How long does it take to become a confident diver? While you may obtain a certification card in five to seven weeks, you probably won't become a really good diver for several years. How many dives does it take? Nobody knows for sure, but estimates range from 50 to 150 dives. It takes years of experience under a variety of environmental conditions to fully understand what is happening around you and how to best handle a dive emergency.

We do have some clues as to why training and experience are so important. A recently published nine year study (by the University of Rhode Island) of diving fatality statistics indicates the majority of dive accidents occurred among people who were making an early open water dive or possessed just a small amount of experience. Many of these victims were



# a good condition for every situation



Let's face it, diving is a sport that takes place under a great variety of situations. There is no single wet suit to cover every possible dive situation. Choosing a wet suit that will prove satisfactory under the greatest variety of conditions isn't easy -there are a lot of wet suits out there to choose from. ☐ But there is a wet suit manufacturer who makes a wet suit for every dive situation and that's Sea Suits. Sea Suits makes a full line of dive suits. A dive suit for every condition plus one more. That extra condition is quality. Sea Suits emphasizes quality because quality is the one condition that covers every condition. Nothing serves as well as having the best. ☐ If you want the best no matter what the situation choose a Sea Suits. We know quality satisfies... it always has and no matter what the conditions it always will.



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
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## EDITORIAL

people who carried a certification card and thought they were competent divers, when in reality they had only limited knowledge. In times of stress, limited knowledge doesn't make it.

The best way to gain experience is to dive as often as you can in the company of a more experienced diver. You can learn a lot from the old timers because they have been there.


How will you know when you have reached that higher plateau of confidence? While it is difficult to describe the essence of inner strength, you will recognize the feeling once you have acquired it. There is a wonderful sense of security in knowing that you can handle any type of diving problem with ease. In fact, you will develop such a sensitivity for the underwater environment that you will be able to anticipate these events in advance, and therefore, be ready to cope with them. You will bask in the warm glow of self-confidence and at the same time develop a sober respect for the awesome power of the sea. Best of all, your inner strength will continue to grow as you continue to dive. 

## MACINNIS FINDS BREADALBANE

Dr. Joe MacInnis realized his dream-of-a-lifetime on August 3, 1980. After three years of fruitless searching, he finally located the *HMS Breadalbane*. Backed with funds from the National Geographic Society, IBM Canada, Dome Petroleum, and Nordaur, and the ice-breaker — *Sir John A. Macdonald* — from the Canadian Coast Guard, MacInnis located the ship under 300 feet of Canadian Arctic waters. His search was aided by this year's freer-floating ice conditions, enabling the Hydrosan side-scan sonar to provide an unexpectedly detailed representation of the ship.

The *Breadalbane* was a mystery left over from the 19th century. A British barque weighing 428 tons, she was headed to the North Pole to look for Sir John Franklin and his 128 shipmates who were searching for the Northwest Passage across the top of the New World.

The Arctic's shifting ice crushed the hull of the wooden vessel, but fortunately, the *Breadalbane* was only one of the two ships seeking the Franklin expedition. The iron-hulled, *Phoenix*, accompanied the *Breadalbane*, and rescued 21 crewmen from her sister ship.

The *Breadalbane* has been identified as the northernmost known shipwreck. She's located 600 miles north of the Arctic Circle and about 125 miles from the magnetic North Pole. MacInnis will return to the site in the spring of 1981. 



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# THE FORCED PERSPECTIVE

**W**hy do some underwater pictures give you a greater feeling of depth than others? The near subjects loom up large and bright, far subjects have sharp definition and contrast, and the water appears delightfully clear. The answer is probably as follows: Forced perspective was used to produce a view that you could never duplicate with your Nikonos 35mm or other standard lens. The photographer used a wide-angle lens held close to the near subject.

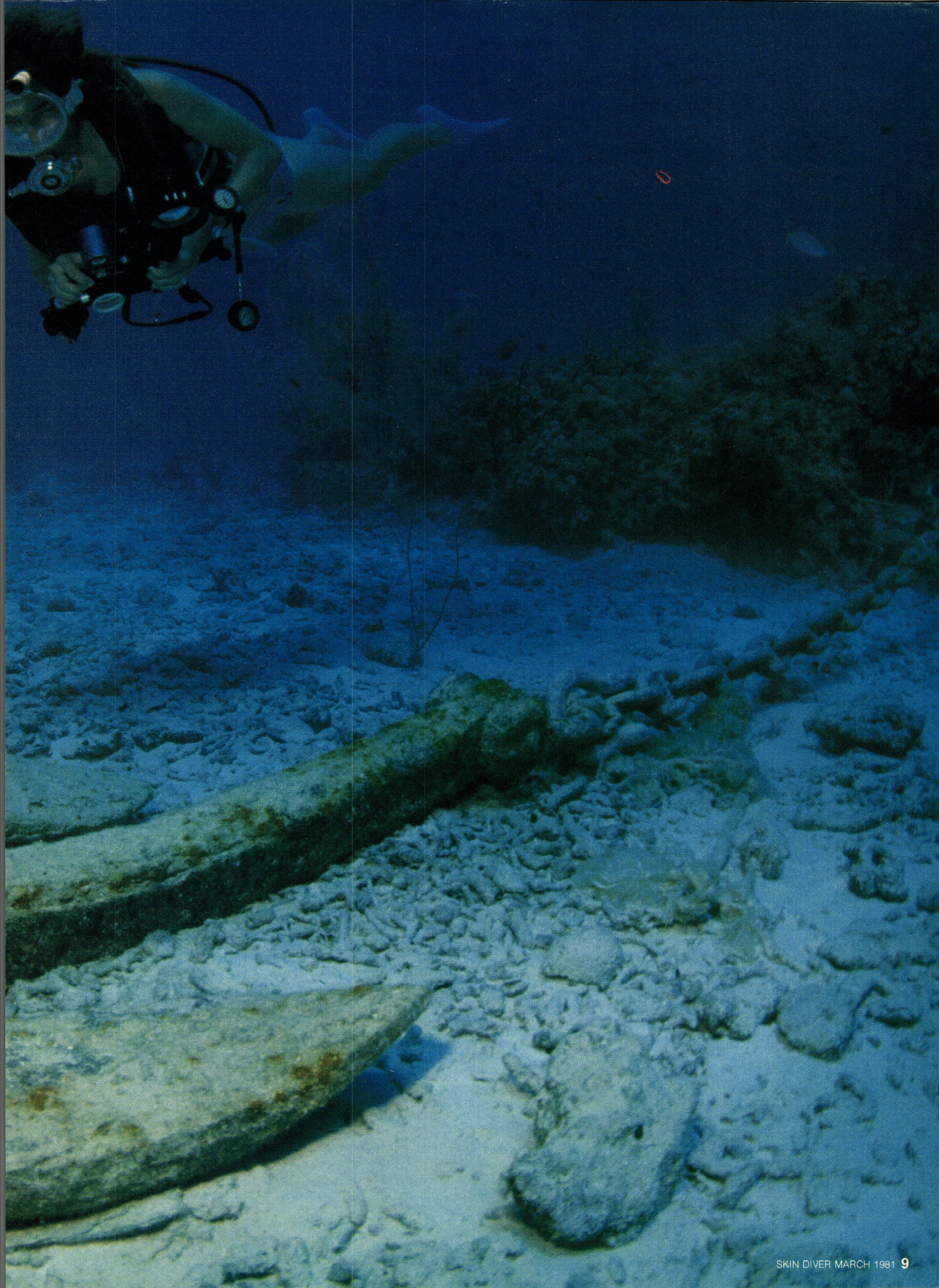
Our basic technique is to use forced perspective in such a way that the pictures appear natural to the viewer. Although we have been doing this for years, the following dive caused us to specifically identify forced perspective as a technique to study, work and share with you.

Our original goal had been to take some wide-angle scenics of three divers swimming over the large sponge and coral formations of the North Wall of Grand Cayman, B.W.I. Jim had drawn his usual stick figure sketches and had discussed the shots with his models. He would be using our new Nikon 16mm full-frame fisheye lens, an Ikelite housing with super-wide dome port and twin Ikelite Substrobes. Lunch was packed because this would be an all-day effort.

Text and Photography by Jim and Cathy Church





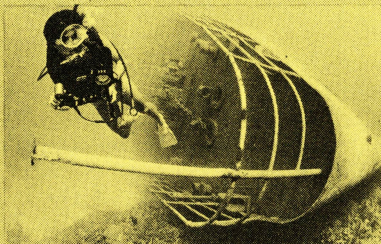




# FORCED PERSPECTIVE LENSES

## A LOOK AT PERSPECTIVE

Size perspective is the difference in relative sizes of near and far subjects in a picture. A normal lens, for example, tends to produce images with about the same perspective your eye sees — both near and far subjects appear in the size perspective you are accustomed to seeing.



Wide-angle lenses, however, often produce a different size perspective — near subjects appear larger and closer than they really are, and far subjects appear to be smaller and farther away. Forced perspective, as discussed in this article, is a method of perspective control: We are deliberately moving in closer than normal to near subject areas to exaggerate their size perspective.

## CHOOSING A LENS

To force perspective effectively, you need a wide-angle lens (about a 20mm or shorter focal length for a 35mm camera). And if you wish to extend your forced perspective to close-up subjects, you should be able to focus the lens in to about a foot from the film plane. We often use the Nikonos 15mm lens because (in our opinion) it combines the best optics with minimum bulk. It has a picture angle of 94 degrees and minimum focus of one foot (.3m). For our U/W courses, we have several Suba-



wider II wide-angle adapters (distributed by Farallon/Oceanic) which slip over the Nikonos 35mm lens. The Subawider widens the 35mm lens picture angle to about 90 degrees and provides a minimum focus of about nine inches (0.25m).

When a 170 degree picture angle is needed, we use a housed Nikon with a 16mm full-frame Fisheye-Nikor behind an Ikelite super-wide

dome port. Please note that there are two types of fisheye lenses. One covers a picture angle of 180 degrees or more, and produces a circular picture area within the frame of film. The others, which are called full-frame fisheyes, fill the entire frame of film because the sides crop the circular fisheye image. Fisheye lenses also produce barrel distortion. All straight lines that don't pass directly through the center will be bowed away from the center of the picture. Thus, if you photographed a perfectly square subject, the four sides would bulge out (like the sides of a barrel) from the center.

## DEPTH OF FIELD

If both near and far subjects are to appear sharp in the picture, they must be within the depth of field of the lens. Depth of field is a zone, extending from a near point to a far



point in front of the camera, in which subjects will be in acceptably sharp focus. Depth of field is dependent on three factors: The wider the lens, the greater the focused distance, and the smaller the aperture, the greater the depth of field.

Some wide-angle lenses and adapters for the Nikonos don't have depth of field scales. And for housed cameras behind dome ports, the lens is focused on an apparent image a few inches in front of the dome rather than on the actual image which may be several feet away. Thus, the depth of field scale doesn't give accurate readings. If your lens doesn't have a usable depth of field scale, look at the depth of field table in the lens instruction booklet or sheet. Use a label maker to attach some commonly used distance/aperture/depth of field combinations to your camera or strobe.

But — beginning with an outboard that never started — there were problems. After an hour of frustration, Jim decided to swim the group to the little wall 100 yards offshore. One of the models, however, announced that her ears were bothering her, and the male model decided to accompany her ashore. We decided (with Jim muttering something about his bio-rhythm) to make the dive alone and photograph whatever we could.

The little wall, as beautiful as it is, was disappointing at first because we were emotionally charged up for the big wall and its larger subjects. Jim settled on a flat sand patch and looked upward at a five foot vertical rise in the coral. A scrubby little gorgonian — less than two feet high — partially blocked his view. Not accustomed to working with the new 16mm full-frame fisheye lens, Jim half-heartedly raised the camera housing and framed the gorgonian in the large Nikon sport-finder. Its image was small, so he moved in closer until it loomed up in the viewfinder. Cathy, who had been watching, swam into the background. Watching her own reflection in the dome port, she positioned herself as a background diver. The scene in the viewfinder was looking good! The gorgonian loomed up large, and the small rise in the coral became a wall. And Cathy, although only a few feet from the camera, became a sharply-defined distant diver adding depth to the picture. Now that we had a new goal — using forced perspective — the disappointment of the aborted boat dive was forgotten.

After finishing our 36 exposures, Cathy thought of a new setup. She gently coaxed a black sea urchin out from under a coral ledge with her snorkel and picked up a spine with her thumb and first finger. Swimming up near the surface, with the ball of sun behind her, she dropped the urchin over Jim. Looking upward through the SLR viewfinder, he watched the urchin's image grow larger as it drifted down toward his camera. He caught the urchin on the palm of his gloved hand and passed it back to Cathy. After several attempts, a basic technique was developed.

We worked the urchin again that afternoon, using film this time, and got our pictures with both strobe fill and natural light. Because the urchin was only a foot or less from the camera, it appears huge in the pictures. And because Cathy was much closer to the camera than she appears to be in the pictures, her images on film were sharp and bright because of the reduced camera-to-subject distance.

## ALIGNING SUBJECTS

The alignment of the near and far subjects often makes or breaks the picture. Think, for a moment, how you would align a near kelp frond or curved finger sponge with a distant diver or large fish. If the



near subject blocks the view to the subject's face or eyes, the picture is a waste of film.

With a Nikonos, aligning your subjects can be tricky because the line of sight of the viewfinder is above the line of sight of the lens. Thus, the alignment you see isn't the alignment you get on film. Tilting the camera or viewfinder to correct the parallax doesn't always work because the lens sees the subject at a slightly different angle than the viewfinder. At medium and long distances, these differences in angles may not be noticeable. But when you are trying to align a near subject that is only a foot or so from the lens with a distant subject, parallax problems become much more troublesome.

Simply aiming a few inches above the intended center of the subject is a common technique for parallax correction. But when aligning near and far subjects, aiming high may not work because you are actually tilting the camera. Jim's favorite technique is to (1) compose picture in the viewfinder without any parallax correct, and then (2) raise the Nikonos until the back of the body is level with his eye when he releases the shutter. Yes, he is shooting blind at the moment the shutter is released, but the alignment of near and far subjects is more accurate. And although the Nikonos 15mm lens viewfinder has a slight tilt for parallax correction at about five feet, the effect is negligible at close distances.

## LIGHTING TECHNIQUES

In clear tropical waters, the sunlight exposure for the far subject and background usually determines the aperture. Therefore, begin with an exposure meter reading for the far subject — let's say f11 for this example. Assuming you wish to use strobe lighting to accent the near subject, look at your strobe exposure chart and find the strobe-to-subject distance for an f11-16 exposure. This will give you soft strobe fill lighting on the near subject. The far subject may also receive some fill lighting, but the basic exposure will be sunlight. If you use two strobes, one for the near and the other for the far subject, be sure to determine the strobe-to-subject distances for each. Having an assistant handhold the second strobe can make your job easier.

Although wide-beam strobes are usually used with wide-angle lenses, a normal-beam strobe can be used to accent a specific subject area such as a diver's face. If you have both a wide and a normal-beam strobe, you can use more varied techniques. The wide-beam strobe can spread light over a wide picture area, while you use the normal-beam strobe to accent specific subject areas.

## CLOSE-UPS

You can also force perspective with close-up subjects. With a Nikonos and a wide-angle lens or adapter that can be

focused down to less than a foot from the film plane, hold the camera in close. The dome port should be only about six to eight inches from the subject. The open ends of tube sponges, fronds of kelp, a hermit crab in its shell, or the face of a friendly grouper, will loom up toward the viewer in your color slides.

Use f22 to maximize the wide-angle depth of field, and start by holding the strobe about a foot from the subject, from above and behind the camera. If strobe light strikes the dome port, you will have unwanted reflections or flare in your pictures. We often use two wide-beam strobes, held at the left and right sides from behind the camera.

Viewfindings will require practice. Use the wide-angle viewfinder to compose the scene, and then move your head back to see exactly where the viewfinder is relative to the subject. Then move the camera upward to place the lens in this relative position and take the picture. Note that you don't look through the viewfinder as you take the picture. You hold the camera as if you were using an extension tube!

## SPECIAL EFFECTS

You can create special effects with forced perspective. In one set of experiments, for example, we laid a Nikonos camera on its back at the base of a small gorgonian. With the 15mm lens set for f22 and one foot, everything from about six inches to five feet from the dome would be acceptably sharp. With the camera body flush against the bottom, we couldn't use the viewfinder. Rather, we looked down at the camera to estimate picture area by looking at the reflection in the dome port. Jim reached in from the side (to avoid getting into the wide-angle picture area) and triggered the shutter while Cathy posed five or six feet above the lens. The resulting pictures gave us a feeling of a diver lost in a barren forest. The many branches assumed the shapes and silhouettes of tree trunks and branches. This technique could also be used with kelp stalks or fronds, and other marine growth.

Another special effect — which has become a standard setup for our photo courses — is the through-the-porthole shot of the wreck of the *Balboa*. A close-focusing wide-angle lens is held about six inches from the circular hole in a steel plate, and a diver poses a few feet beyond. The hole is lined with fire coral and small seafans; in the finished picture, the small hole becomes the entrance to a large tunnel lined with giant fire coral and fans framing an inquisitive diver.

## SOLVING PROBLEMS

You can expect to encounter the following problems, but you can work around them:

1. Finding subjects may be difficult until you develop an eye for spotting po-

tential set-ups. The foreground subject must be something that distortion won't make ugly — it must be well-defined and not too small. Solution: A practice dive with an empty camera (or with just the wide-angle Nikonos viewfinder) is an excellent way to train your eye. Get low, get close and look upward at everything through the viewfinder. Get closer than you have in the past. If you don't have the patience to practice with an empty camera, then practice after you've shot your last frame of film.

2. When working with upward camera angles, any bubbles from your mask, BC, regulator or hoses will float up into the picture. These bubbles can also adhere to the outer surface of your dome port. Solution: Keep your dive gear in top condition, and time your exposures with your breathing to keep exhaust bubbles out of the pictures.

3. The front edge of your strobe may show up in the corner of the picture area, or it may be close enough to cause backscatter at the edge of the picture. Solution: The strobe must be held behind the camera or well to the side. When using the 35mm format, try holding the strobe above or below the subject when shooting horizontals. And when shooting verticals, try holding the strobe to the side.

4. Models may find it difficult to work close to the camera. Because of past experience, they usually back away to about three feet or more. Solution: Be patient! Have the model swim over to your position and look through the wide-angle viewfinder. This provides a better understanding of what the scene looks like. Above water, show the model pictures — both good and bad — and use simple, stick figure sketches to illustrate the scene you want. Tell the model to help compose by looking at her/his reflection in your dome port. But when you signal that you are about to take the picture, the model should look away from the lens.

5. Unwanted subject matter — such as fins, the arms or legs of other divers, anchor lines or distracting backgrounds — can show up in the finished picture. Solution: Examine the entire scene in the viewfinder from edge-to-edge and corner-to-corner. When you are concentrating on the main subject you see in the central section of the viewfinder, you can easily overlook these distractions.

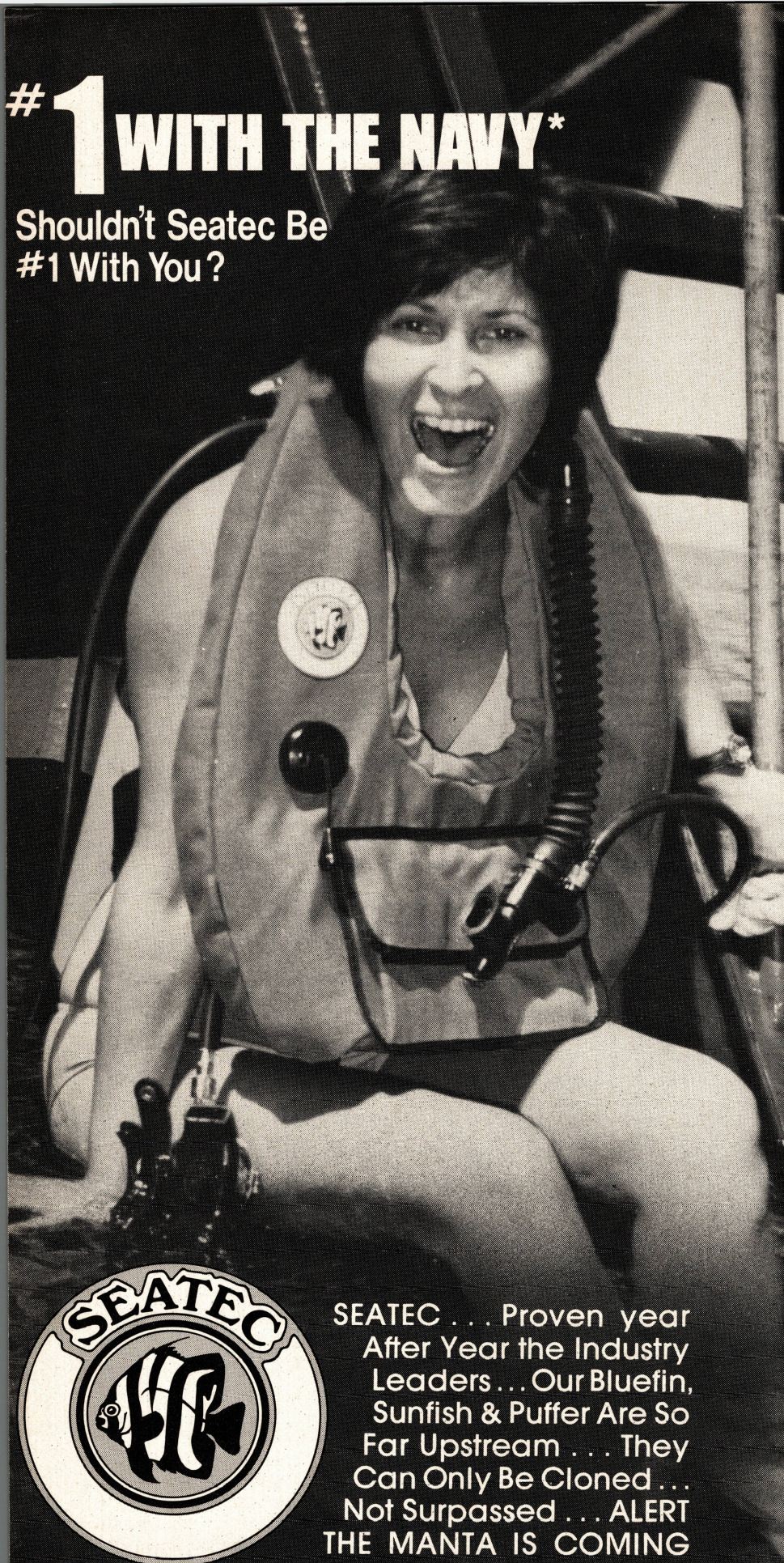
6. Your pictures didn't turn out as planned. Solution: Analyze your results, then go back and try again. Even the practiced professionals sometimes have to reshoot to get the results they want. And if conditions won't allow you to photograph as planned, don't be afraid to shoot for an alternate goal.

7. Depth of field may not cover both the near and far subject? Solution: You must make a decision! Set the focus so the most important subject area, either near or far, will be sharp. The viewer will tolerate one soft subject area, not two. ➤



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## Diver's Calendar

**March 10** Underwater Archaeology in Canada, Hart House Underwater Club, University of Toronto, Ontario, Canada (Contact: Glen Cauterman, NAUI 2032, 1294 Islington Ave., Apt. 304, Islington, Canada M9A 3K2)

**March 14** Boston Sea Rovers 27th Annual U/W Clinic, Boston University at John Hancock Hall (Contact: Glen Reem, 30A Rockville Ave., Lexington, MA 02173)

**March 20** NAUI North Atlantic Branch Annual Ken Reed Memorial Underwater Photo Contest. All Entries deadline: March 20. (Contact: Mr. Tracy Tibedo, 75 Leland Farm Rd., Ashland, MA 01721)

**March 20-21** Man and the Sea Conference, Temple University. (Contact: Robert Leahy, Center for Marine Studies, Temple Univ., Philadelphia, PA 19122. (215) 787-8720).

**March 25** Nitrogen Narcosis and Anxiety, Hart House Underwater Club, University of Toronto, Ontario, Canada (Contact: Glen Cauterman, NAUI 2032, 1294 Islington Ave., Apt. 304, Islington, Canada M9A 3K2)

**March 27-29** Man in the Sea Symposium, Seattle Center North Court Rooms, Seattle, WA (Contact: Man in the Sea Symposium, P.O. Box 4505, Federal Way, Seattle, WA 98003)

**March 27-29** Underwater Canada '81, Skyline Hotel, Toronto, Ontario, Canada (Contact: Ontario Underwater Council, 160 Vanderhoof Avenue, Toronto, Canada M4G 4B8)

**April 4** Underwater '81 NAUI Underwater Symposium, Harvard University, Science Center, Boston, MA (Contact: John Burrage, 29 Hull St., Beverly, MA 01915)

**April 4** Underwater '81 NAUI Underwater Film Review, John Hancock Hall, Berkeley St., Boston, MA (Contact: Fred Calhoun, P.O. Box 291, Back Bay Annex, Boston, MA 02117)

**April 4-5** 1981 California Beach Dive Photography Competition, Monterey, CA. Sponsored by Alameda Divers and Aquarius Dive Shop. (Contact: Jim Stratton, contest chairman, 649 Pacific Ave., Alameda, Ca. 94501)

**April 5** Northeast Divers Underwater Film Festival, Marywood College, Scranton, PA. Stan Waterman will be featured. (Contact: Joe Donahue, 324 South Main Ave., Scranton, PA 18504)

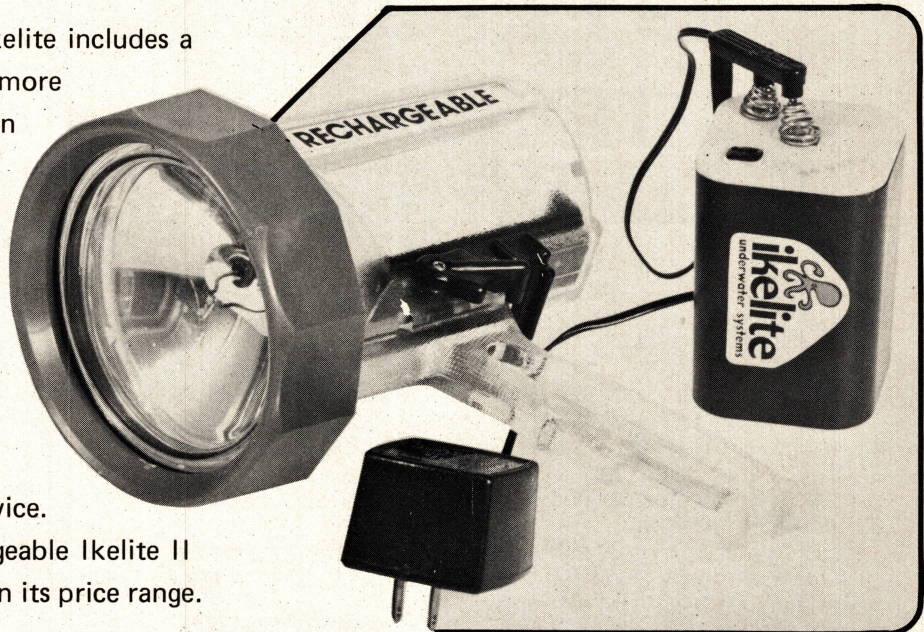
**April 11** Fluid Visions II, Queen Mary, Long Beach, CA. (Contact: Karen Straus, PADI, 2064 N. Bush St., Santa Ana, CA 92706)



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## HAWAIIAN CHAMBERS

It was reported in the December, 1980 issue of SKIN DIVER that the U.S. Navy Pearl Harbor Recompression Facility would no longer handle civilian cases. The Navy has assured SDM that this is not true and that it will continue to treat civilians. In an emergency the number to call is: (808) 422-5955.

The Big Island Chamber Association (BICA), an all-volunteer organization, expects to be back in operation this month with new equipment. The facility is in Kailua-Kona at the Old Kona Hospital. In an emergency, contact the Hawaiian County Emergency Squad: (808) 961-6022.

## FILM EXPEDITION

Hardy Jones, producer of the award winning film, *Dolphin* has two expeditions in the Sea of Cortez scheduled (June 6-12 and 13-19, 1981) to carry out filming for a new documentary he is producing. Top filmmakers and scientists will be aboard the *Don Jose* as well. The trip fee of \$795 per person can be tax-deductible. Limited spaces are available. Contact Living Ocean Society, P.O. Box 855, Sausalito, CA 94966 or phone (415) 332-5410.

## CYSTIC FIBROSIS SCUBA-THON

The Dive Shop, Inc. and the Divemaster Association of Greater St. Louis raised over \$1,500 for the Cystic Fibrosis Foundation at their Scuba-Thon. The event was held underwater at Sugar Creek Sports Club for 50 continuous hours. Lynn David, program chairman, was so pleased with the fund raising event he promised to make the Scuba-Thon an annual event.



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C.D.C. is an integral part of one of the world's largest diving contractors... Oceaneering International, Inc., which is C.D.C.'s parent company and which has three out of five of the major deep water contracts, and the majority of the most expensive underwater exploration, construction, and maintenance projects. O.I. is heavily involved in over one-third of the world's oil platforms.

## The fact is:

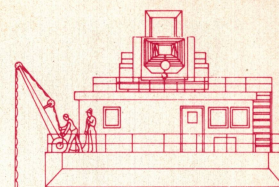
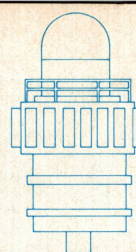
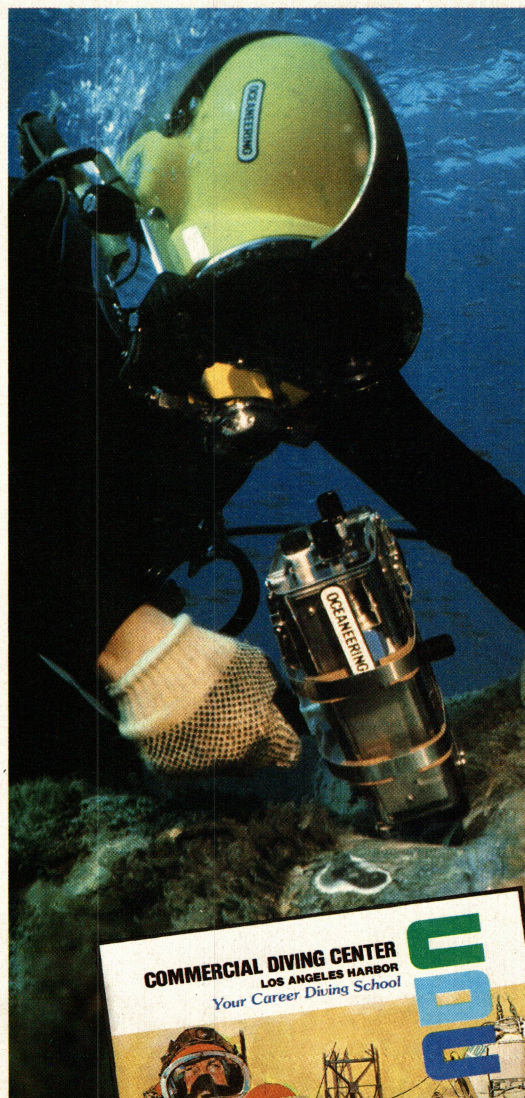
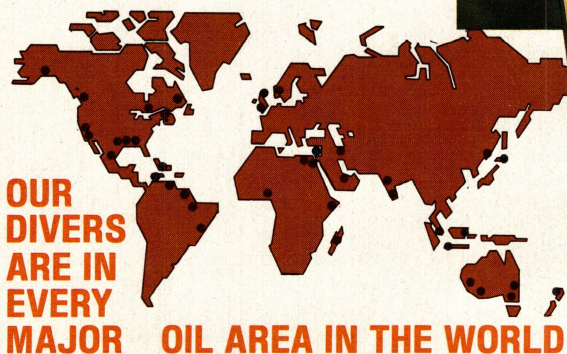
Oceaneering International designed Commercial Diving Center's training programs, moving over 40% of the graduates into key jobs under world-wide diving contracts. The others may opt to work for some 200 diving contractors who look upon C.D.C. as a producer of high-quality trainees ready to take on any job with any type of equipment.

## The reason is:

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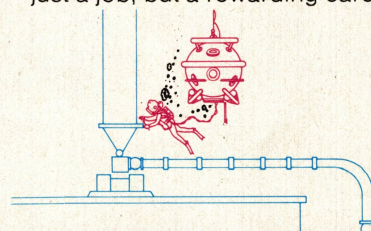
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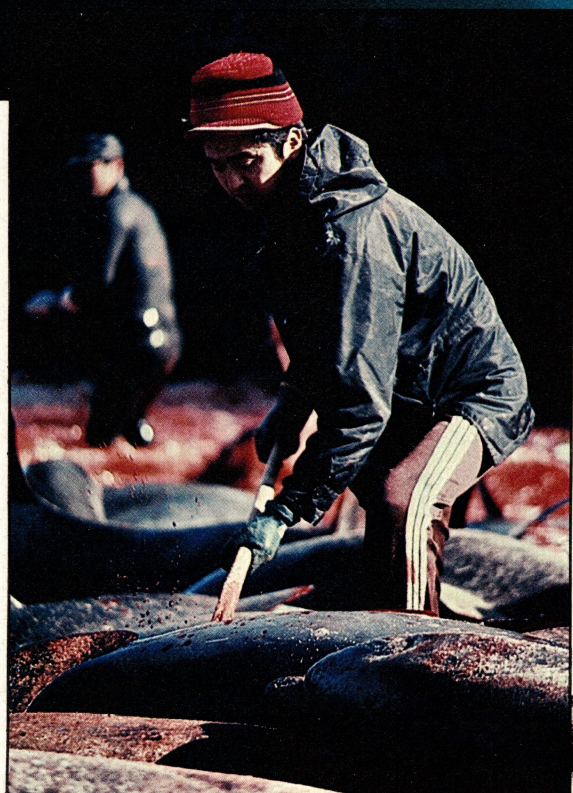
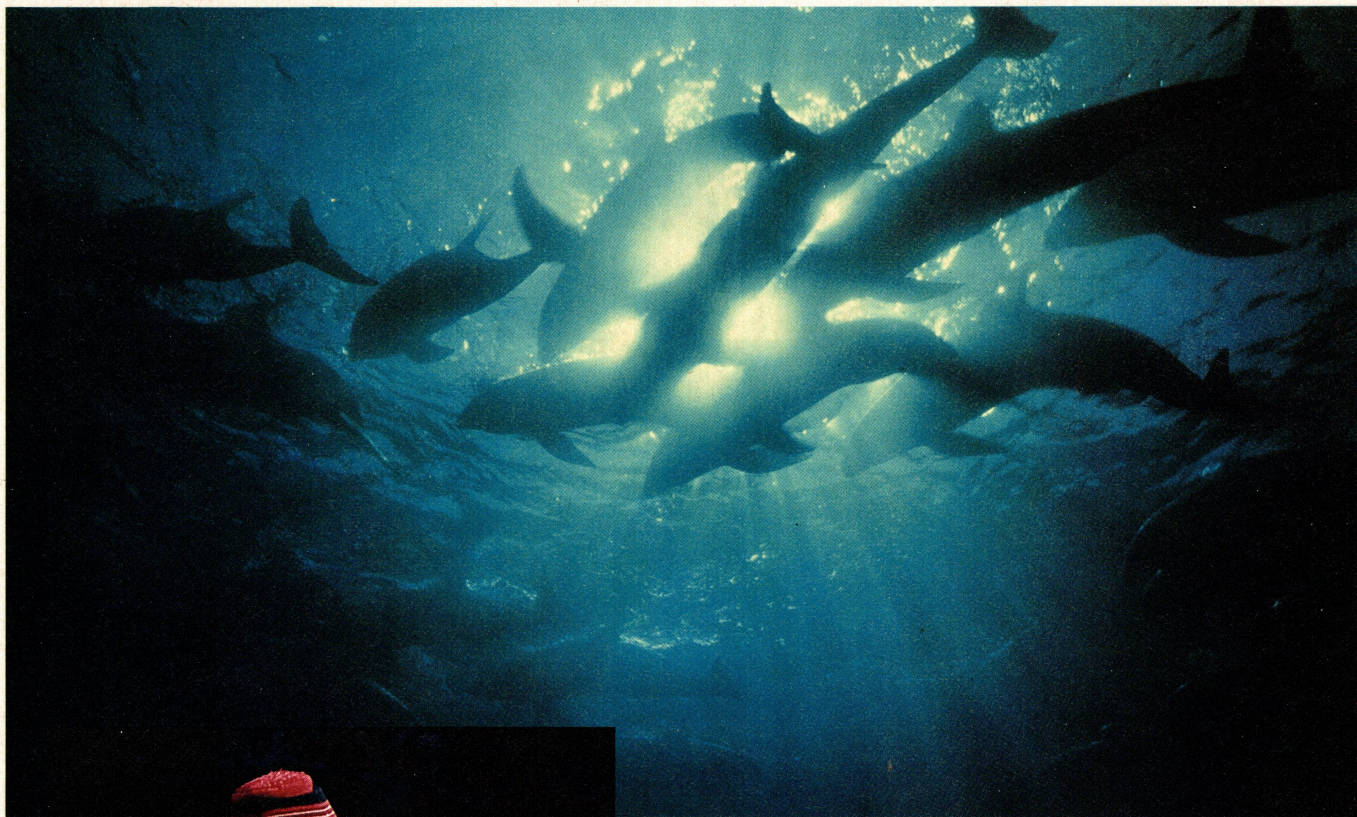
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# BLOOD BATH AT IKI

Dozens of bottlenosed dolphins and false killer whales littered the beach on Tatsunoshima Island. Tatsunoshima is where the massacre actually takes place and is near the larger Iki Island. The animals had been trapped in nets when the tide receded and were dying in the sun. Men lanced the trapped dolphins on the beach and in the water.





I was crawling through the bushes approaching the last sand dune before the beach. Hardy Jones (director of the Breach Foundation) was right behind me and every so often he would signal for me to keep down closer to the ground. It's difficult to keep a low profile when you are dragging an assortment of both still and motion picture equipment on a cross-country crawl over a bush covered island, but I did the best I could. I was anxious to get to the sand dune, not only because it looked like an excellent place to hide, but also because it was the last obstacle preventing us from seeing what was happening on the beach. We reached the sand dune and paused to rest for a moment. Then we glanced briefly into each other's eyes before climbing to the top of the dune. What we were about to witness on the other side was the reason we had come to Japan, but neither of us was looking forward to the experience.

Before I raised my head to look down on the beach, I adjusted the aperture and focus settings on my movie camera. I wasn't sure how long I would be able to film before being discovered. Then we climbed the last few feet.

## Man Versus Dolphin in the Final Struggle for Fish Resources

Text and Photography by Howard Hall

What we saw was a scene out of a nightmare. The beach was littered with dozens of bottlenosed dolphins and false killer whales. They had been trapped in nets and after the tide receded, were left to die in the sun. Half of these were already dead and the rest only occasionally struggled as the sun leached away their remaining strength. I could hear their voices as they called out to each other in whistling cries that sounded like some kind of badly played musical instrument. But a scene far worse was taking place about 300 yards away on the far side of the small bay. It was difficult to see detail, but there were men and dolphins in the water together and the water was brilliant red. Occasionally a struggling dolphin would send flaming fountains of bloody water 20 feet or more into the air. My hands may have been shaking slightly as I focused on the distant beach.

Although the massacre was taking place some 300 yards away, both Hardy and I cringed at the sound of the movie camera. We had no idea what the fishermen would do if they discovered us. They had warned us against coming into Katsumoto town on Iki Island and they had prohibited all fishermen from taking us to Tatsunoshima Island (the small island

near Iki where the massacre takes place). But, we had found one old man who owned a skiff and who hadn't received the word. Fortunately, when we emerged from the bushes, we had found ourselves on the far side of the bay and away from the fishermen. If we kept down we would be safe here — or so I thought.

I heard a sound and looked to my right. My mouth went dry when I saw two men coming swiftly toward me, one with a blood covered lance. They were gesturing frantically with their arms at my camera and it was obvious that they intended for my filming to cease. I stood up and smiled.

"Get down, for God's sake," Hardy said. He hadn't noticed we had company.

"Never mind, Hardy." I said, "I'm afraid we have visitors." He stood up immediately and came to my side. I put my camera back in its box.

The only form of communication between the fishermen and us was sign language. But it was obvious that they were concerned about what to do with us and our cameras. They were confused as to how we had managed to get on the island. At that moment, Dexter Cate and

his wife, Suzie, emerged from the bushes. They had come over in the skiff with Hardy and I. Then, suddenly, a helicopter appeared overhead. It came down close to the beach and we could see that there was a news film crew aboard. Hardy had called every environmental group he knew when he discovered the Japanese had rounded up 800 dolphins at Tatsunoshima. One of these calls must have triggered a Japanese news crew. The low-flying helicopter created confusion which helped me break away from the others and walk toward the killing beach.

When I walked onto the beach where the massacre was taking place, the fishermen didn't know what to do. One gestured at me with his lance, another offered me a beer. Each time one of the men gestured for me not to film, I would put my camera away then walk down the beach a few yards before resuming. The fishermen must have thought that I had come from the helicopter. I think they would have been more aggressive had they known I had come over on a skiff and crawled through the bushes.

In the small cove, the fishermen had 200 or 300 dolphins trapped in a net. Men wearing wetsuits were in the water lancing the dolphins, then tying ropes around

their tails so that groups of about 30 fishermen could drag the injured dolphins up on the beach. Once the dolphins were on the beach, other men would lance them several more times. Then, the animals were left to bleed to death.

Hardy, Dexter, and Suzie joined me at the cove. We were allowed to film and observe the overpowering scene unharassed as the fishermen accepted our presence. I tried to detect some indication of remorse on the faces of the fishermen. There was none. To these people, the dolphins were no more important than anchovies are to us. How could they possibly understand our point of view?

The Iki massacre is a symptom of a worldwide disease — a disease of world ecology of which man is an integral part. Although this is a disease of our entire planet, Japan is showing some of the most dramatic symptoms.

Japan depends heavily upon the ocean for food. The demand for seafood has led to extreme overfishing of coastal waters. This, combined with pollution due to industrialization has decimated the coastal fishing resources of the country. There are only a few isolated areas where coastal fishing is still possible. Iki is one of these. And, fishermen continue to move there, the fishing banks are becoming increasingly crowded, and the rate of overfishing is accelerating. Although the fishermen catch less and less all the time, the prices continue to climb due to shortages. An average 15-20 pound yellowtail can be sold by the fishermen for about \$15. In Tokyo, the same fish can bring as much as \$50. The fishermen don't need to catch many fish in order to survive and this high price encourages them to deplete the yellowtail population.

Meanwhile, the dolphins migrating through Japan's coastal waters must follow the fishing resources also. They end up in the same place as the Japanese fishermen, competing for the same fish. Sometimes the dolphins take the fish right off the fishermen's lines. They are in direct competition with the fishermen for food and as fishing resources decrease, the fishermen find it increasingly difficult to allow the dolphins their share. As the fishermen see their way of life threatened, they look for even the most desperate solution to their problem. The Iki massacre becomes an act of this desperation.

Of course, massacring 2000 dolphins per year out of a population of several hundred thousand is not a reasonable solution. It costs the fishermen money to round up the animals despite the bounty that the government pays on each animal. And, dolphin meat has little or no economical value. It is so polluted with mercury that it should not be eaten. The





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## IKI MASSACRE

Iki dolphins are either buried or ground up for fertilizer. But in some parts of Japan the people do eat dolphin meat despite the mercury content. And even more frightening, the Japanese government is backing studies to determine increasing ways of utilizing the dolphin populations. Desperate men seldom act reasonably.

The Iki massacre is not a unique incident. Similar things have been taking place all over the world. Humpback whales have been killed because their food resources in offshore Newfoundland waters have been destroyed by overfishing, driving them inshore where they menace fishermen's nets. The same is true with minke whales. Beluga whales and killer whales have been killed for similar reasons. The problem touches close to home when the sea otter is considered. If allowed to reinhabit its ancestral range, the sea otter will greatly influence dwindling populations of abalone on the coast of California. It is easy to blame the Japanese for environmental atrocities. But they are not alone.

So, what is the solution? It comes in two parts. The symptoms of this disease are being treated by environmentalists wherever they pop up. The Canadian government is considering a plan to pay a bounty on every live whale released unharmed from fishermen's nets in Newfoundland. Devices have been invented to frighten beluga whales away from fishing grounds. And world pressure on Japan to stop the Iki massacre is great.

But the final solution is in you and me. It is how we feel, our values and our attitudes. You don't even have to do anything. When enough of us feel that it is morally wrong to exploit our environment at the expense of wildlife and wilderness habitat, the killing will stop.

As divers we have the best reason to place value on the marine environment. For many of us, it is our second home. And when this environment is affected by the careless exploitation of others we are the first to see the results. Through our interaction with others, our photographs, our home movies, our tales of adventure and beauty in the ocean environment we will have a significant effect on world opinion. Over a period of time, if man is to survive, world values will have to change.

During the night following the massacre on Tatsunoshima, Dexter Cate crossed the treacherous channel once again in an inflatable kayak against 30 mph winds. Under the cover of darkness he cut the nets and freed the remaining dolphins. The following morning he was arrested and subsequently spent four months in a Japanese prison. His was an

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almost unbelievable gesture of courage and sacrifice.

While Dexter was being arrested, Hardy and I were rushing our valuable film and still photos out of Japan. It was a long and thoughtful flight back to the U.S. We have dived with dolphins in many parts of the world. We have seen their joy of living, witnessed their devotion to each other, and felt their superior intelligence. Now our beautiful memories will forever be haunted by the songs of dolphins dying in the sand. >

## NEW POOL

Berry Atlanta has a new training pool. Divers traveling through Atlanta on their way to Florida are invited to stop in at this PADI five-star training facility to simply get wet or to try out the latest in equipment.

Berry Atlanta offers the complete PADI training program and a free introductory scuba program every night, according to Mark Calhoun, manager. It is at 3443 Stewart Avenue, Hopeville, GA 30354; (404) 766-1186. >

## CDC RETIRES HARDHAT

In a major move toward modernization of its inventory of commercial diving helmets, Commercial Diving Center is retiring the traditional hardhat, a symbol of deep sea diving throughout history.

Commenting on the event, CDC's executive director, Jim Joiner, said, "We have been anticipating the evolution of this drastic break with tradition for the last few years. Our close ties with the dive contractors indicated that the hiring firms were phasing out the old style helmets in favor of the new, and the school's inventory has kept pace with the change.

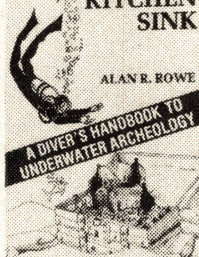
"The decision was a real nostalgia trip for our veteran instructors who had been trained in hardhats... but they were won over by the increased safety and working advantages of the new helmets."

Commenting on the surveys of the needs of the hiring firms, John Robertson said, "The momentum of firms switching over to the new modern helmets was universal. Continuing to train our students in the old style helmets... as great as they were in their time... was not practical. The employers need, want, and demand graduates with concentrated training in new equipment, and in keeping with CDC's traditional innovative policy, we will launch 1981 with a brand new shift in emphasis."

As drastic as the changeover may appear to diehards who will resist changes of any kind, CDC's decision mirrors that of both the U.S. Navy and the British Royal Navy, who no longer include the old style hats in their training programs for new divers. >

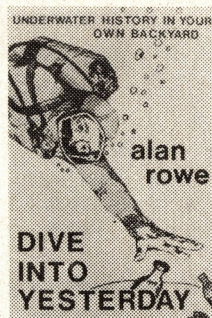
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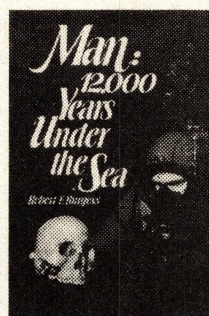
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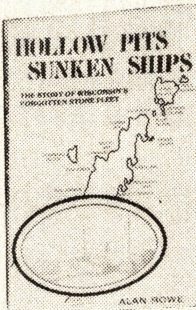
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# Film Festivals 'n Symposiums

## FLUID VISIONS II

PADI will present its second underwater photo exposition, Fluid Visions II, on Saturday, April 11. The exposition will be held aboard the *Queen Mary* in Long Beach, CA.

Jim and Cathy Church — underwater photo editors for SKIN DIVER Magazine — will head the program and present, "The Art of Composition" and "Strobe Lighting Techniques." Jack McKenney will show his new film *The Bahamas: Of Dreams and Divers*.

Other U/W photo experts giving presentations will be: Robert Evans and Hillary Hauser — co-authors of *The Living Reef*; Ron Merker — *Down the Eyeball*; Bob Wohlers — *Star Wars*; and Dennis Graver — *Transparency Posterization*. Al Hornsby will present the 1980 Underwater Photographic Search Competition Winners.

Included with the program will be a continental breakfast, slide viewing, discussions, exhibits, a wine and cheese social and door prizes. Along with a

chance to meet the experts, those who attend will receive a certificate of participation.

A Fluid Visions II Catalina boat dive will be offered to all attendees on Sunday, April 12th, but space is limited. Arrangements should be made through Scuba Schools of Anaheim, 1640 W. Lincoln Avenue, Anaheim, CA 92801 (714) 956-5540 or Scuba Schools of Long Beach, 4740 E. Pacific Coast Highway, Long Beach, CA 90804 (213) 433-6765.

The exposition will be in the Grand Salon of the big vessel from 8:30 am to 8:30 pm. Free parking is available. For additional information contact: PADI, 2064 North Bush St., Santa Ana, CA 92706 or call (714) 953-7555.

## FILM FESTIVAL AND EASTER EGG HUNT

San Francisco bay area and Monterey, California dive stores will sponsor a double event the weekend of April 11-12. On Saturday, April 11, there will be a film festival featuring well-known cinematographer Jack McKenney, whose films show diving in such locations as California, the Bahamas, Florida and the Red Sea.

On Sunday, April 12, an Easter egg hunt will be held with many attractive prizes. Tickets for both events are \$6, if purchased prior to April 11, or \$8 if purchased at the gates. Both events will take

place in Monterey, California.

For further information contact your San Francisco bay area or Monterey participating dive store.

## ALS SYMPOSIUM

Films about the sea, both above and under the water, will be featured at the American Littoral Society's 11th annual symposium *Your Future in the Sea*, at the American Museum of Natural History in New York City, Saturday afternoon and evening, March 28.

Among those on the program are: Robert Marx, covering treasure diving; Richard Ellis, whose new book, *The Book of Whales*, has just been published; Eugenie Clark, just back from diving off the coast of Japan; Jack Casey, on shark studies. There will also be coverage of marine turtles; sailing the Cape of Good Hope; and the art and science of underwater photography.

The program runs from 1-4:30 in the afternoon and from 8-10:30 in the evening. Tickets are \$4 for the afternoon, \$5 for evening or \$8 combined.

For tickets or information write American Littoral Society, Highlands, NJ 07732, or phone (201) 291-0055.

## NORTHEAST DIVERS U/W FILM FESTIVAL

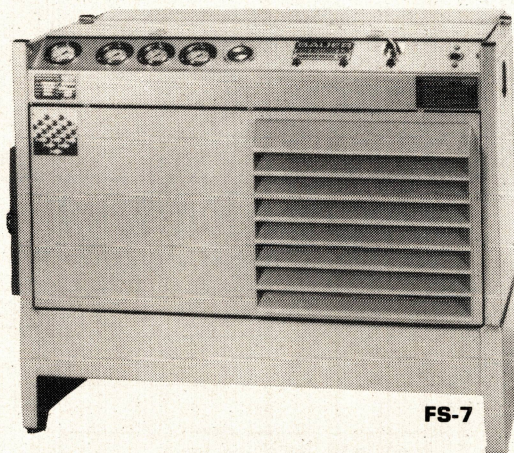
The Northeast Divers Underwater Film Festival will be held at Marywood College

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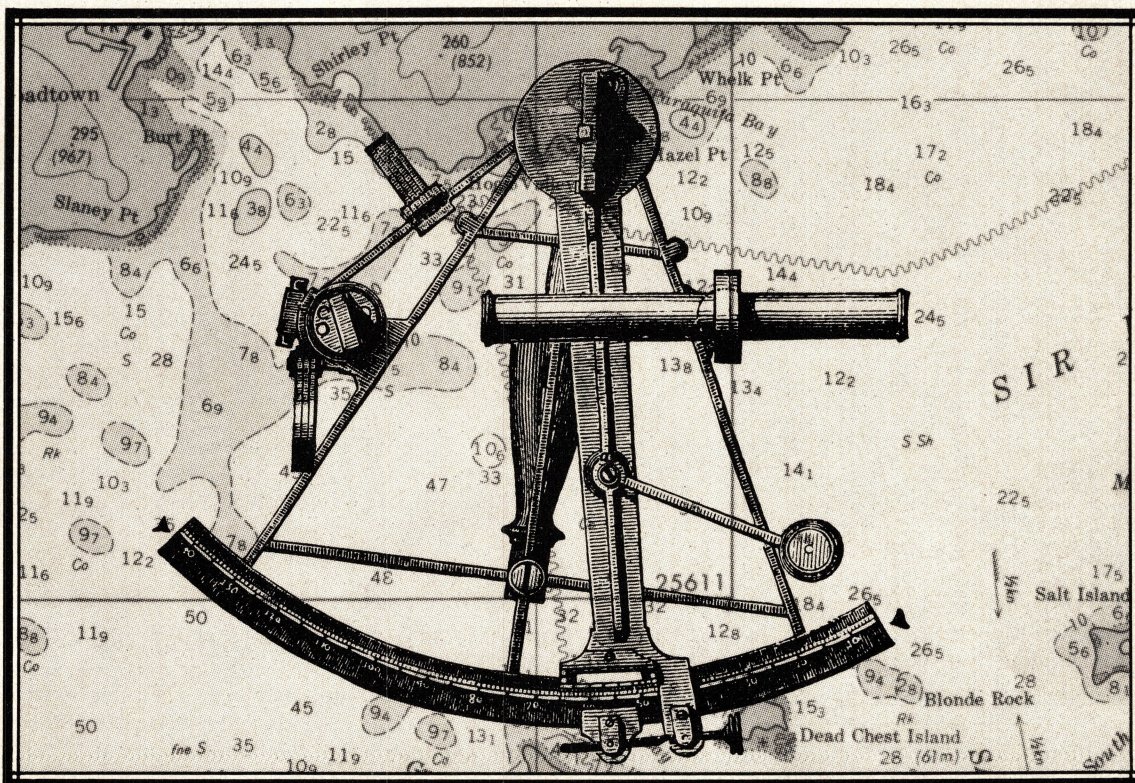


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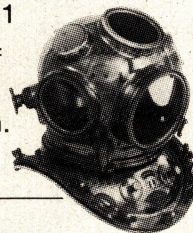


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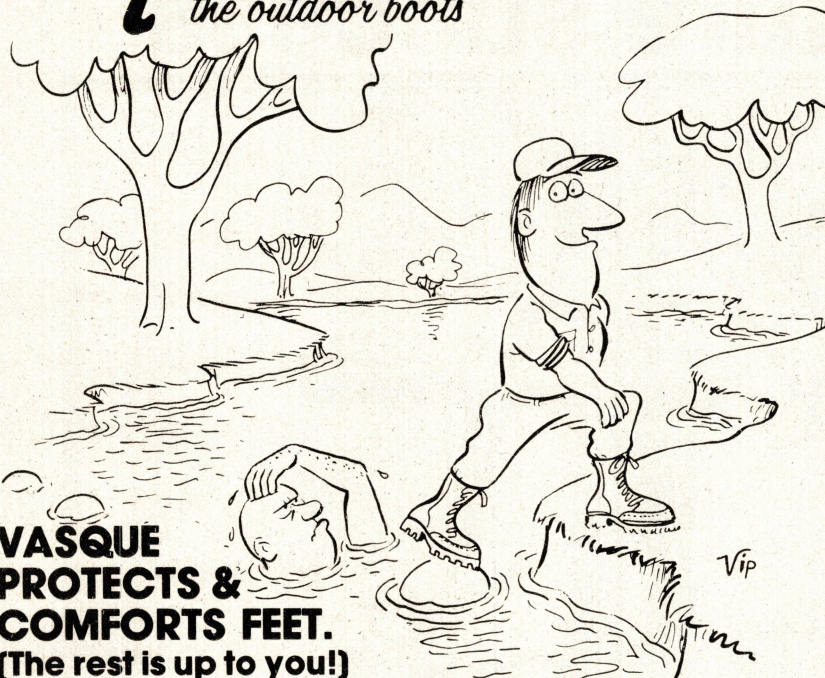
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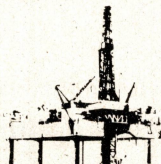
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## FILM FESTIVALS

(Continued on Page 28)

in Scranton, Pennsylvania on Sunday, April 5 from 1:00 pm until 5:00 pm.

This year's festival will feature Stan Waterman. Sharks, treasure hunting, tropical reefs and many other areas of activity in the sea are the subjects for Stan's camera and provide the material for this in-person presentation.

Also featured this year is Temple University scuba director, Dr. Robert Leahy, presenting an audio-visual experience. Dr. Leahy will also participate in a discussion on North Atlantic wreck diving and a review of Northeast Diver's 1981 wreck diving sites.

There will be an exhibit area devoted to U/W photography and advanced diving programs. A divers' social is scheduled to follow the day's presentations.

The cost of the entire show is only \$3 in advance, or \$3.50 at the door. For information write: Northeast Divers, Inc., 324 South Main Avenue, Scranton, PA 18504 or call: (717) 347-7221.

## NAUI UNDERWATER '81

The multi-faceted Boston show enters its 15th year on April 4, 1981, making it the longest running NAUI program in the world. Scheduled from 10 am to 5 pm at Harvard University's new Science Center, the Underwater Symposium under the direction of John Burrage will cover such diverse subjects as: How To Dive in Vermont, The Whole Truth About the Octopus Regulator, Underwater Photography in New England, Wreck Diving in the North Atlantic, Marine Biology of the North Coast, Women in Diving, Underwater Habitats, Search for the *Titanic*, Dive Medicine, Tropic Diving, Diving

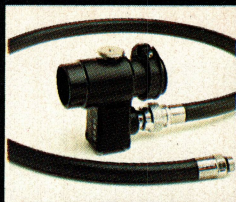


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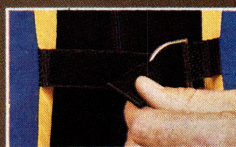


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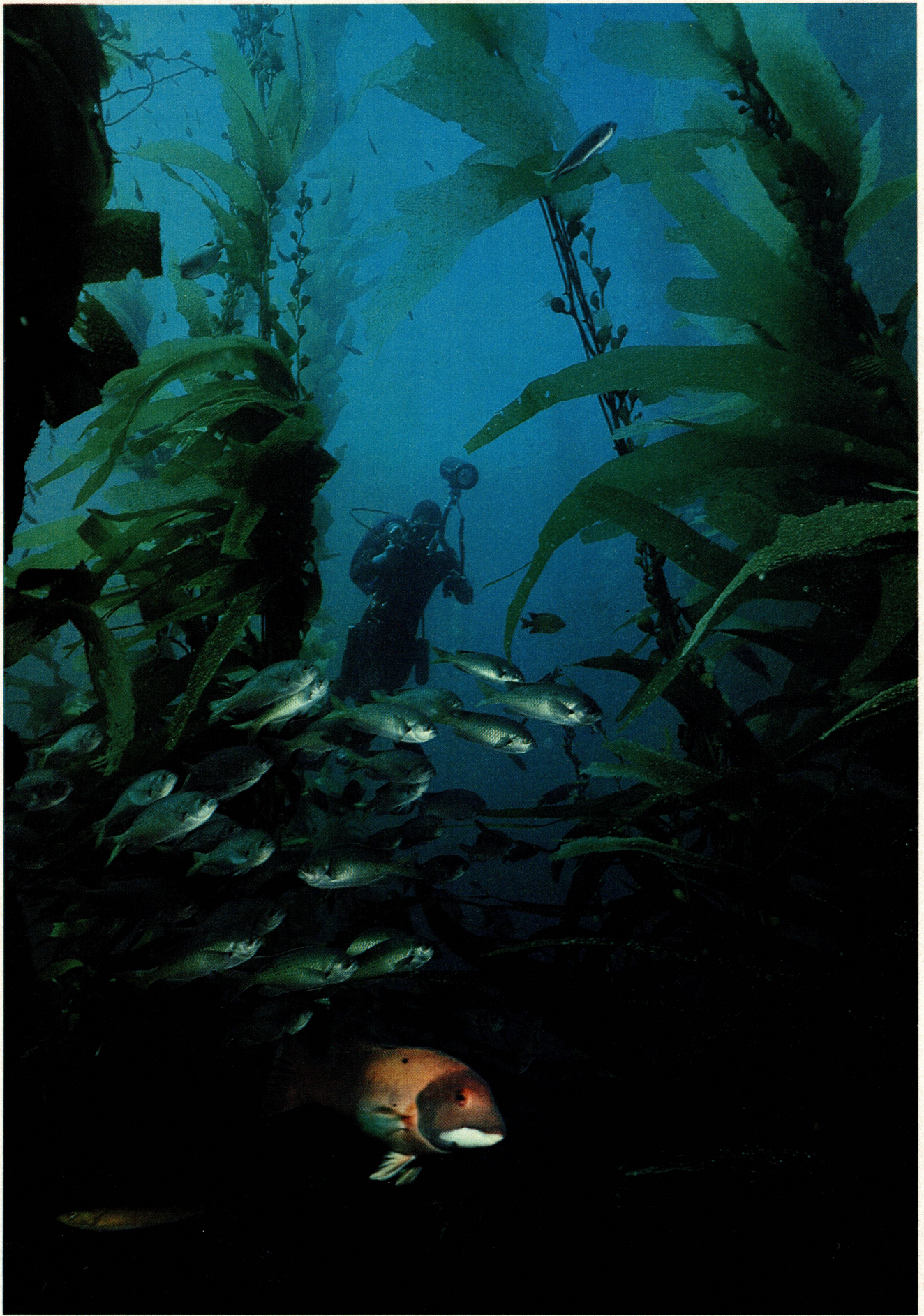


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All of us have at some time experienced moments when we are suddenly overwhelmed by our natural surroundings. For some people I suppose those times come during a hike to the rim of the Grand Canyon, for others, when watching a colorful Caribbean sunset. But for me and thousands of Southern California divers, those moments come while we are swimming through a Pacific Ocean kelp forest.

Unquestionably, Southern Californians enjoy diving days that cannot be surpassed in water anywhere in the world. I will concede, to those who insist, that California's scenery can be equaled. But, life just cannot be any sweeter than it is when you are cruising through a kelp forest on a perfect day. The Pacific is calm and warm and there is hardly a cloud in the sky. Bursts of sunlight dance through the kelp beds, light rays flickering as waves pass gently overhead. Bright orange garibaldi, curious sheephead, and schools of silver colored Pacific jack mackerel accompany the divers. In the reef substrate moray eels, abalone, and colorful invertebrates such as starfish and lobster await our visit. At times California divers are joined by sea lions, harbor seals, schools of yellowtail, and on rare occasions even California gray whales are seen in the kelp forests.

The kelp beds I am referring to extend from Santa Cruz, California southward along the coast and nearby islands to Turtle Bay, about halfway down the Pacific side of Mexico's Baja Peninsula. The mainstay of these beds is one particular type of kelp, *Macrocystis pyrifera*, a form of algae. Kelp plants are usually seen in patches, referred to as beds or forests, and

# CALIFORNIA KELP FORESTS

Text and Photography by Marty Snyderman

any one bed can cover up to ten square miles, although most are not that large. Not only do the beds of *Macrocystis* provide excellent diving and a refuge for many marine species, but the plant is commercially harvested for use in many industrial and household products.

Commonly called giant kelp, *Macrocystis pyrifera* is a brown seaweed that has descended from plants which survived the ice ages. Seaweeds are not as complex as flowering plants but in many forms have demonstrated a remarkable ability to survive in rather demanding conditions. Giant kelp thrives in areas where there is enough water motion and current necessary to provide a continuously renewed supply of nutrients, in conditions where many plants would quickly perish.

The largest plant in the marine environment, giant kelp is also the ocean's fastest growing plant. It begins its life cycle from a single microscopic cell that divides itself and, in only six or eight months of good conditions, a kelp plant can grow to reach the surface. Healthy beds are only found in areas where the water temperature stays between 50°F and 68°F and whose bottom terrain is mostly rock or shale. The bottom in most cases is between 25 and 90 feet deep. Giant kelp does not just grow from the bottom to the surface but spreads out at the surface to form a floating canopy. Individual plants may reach lengths of over 200 feet.

Giant kelp has no roots but depends instead on a system of short, thin, sturdy root-like structures called haptera. Collectively, the numerous haptera form a holdfast which attaches the plant to the bottom terrain. The holdfasts are well designed for gripping the substrate as well as for resisting the constant shock and pull of wave action, surge, and current. *Macrocystis* holdfasts, different than many holdfasts, are best suited for attaching to solid rock or slate and cannot develop on bottoms

that consist of silt, sand, or mud. In areas where sewage is dumped, creating a silty bottom, the holdfasts are incapable of attaching themselves and giant kelp cannot survive under such conditions. This fact explains the demise of many kelp beds near the sewage outfalls of large cities. It is important to note that not only does the kelp plant suffer, but the entire ecosystem is severely threatened.

Under normal, healthy conditions, individual kelp plants often grow close together forming a majestic undersea forest. The canopy formed on the surface of the water is often thick and greatly reduces the amount of sunlight penetrating to the bottom. It is a beautiful experience to dive underneath the canopy in a world that wears many different appearances depending upon water and weather conditions. During days that offer good dive conditions few places look more inviting, but on rough and stormy days the shadow-filled forests appear rather dark and ominous.

Describing kelp beds as magnificent undersea forests is a valid analogy in many ways. Kelp forests do, in fact, provide a refuge for so many marine organisms that it is difficult to comprehend the sheer numbers. Studies have shown that over 178 different forms of life exist in just the holdfasts alone and 114 motile species are commonly found in and around the fronds, the portion which includes the stipes and blades. Ron McPeak, the senior marine biologist at Kelco, a kelp harvesting and processing company in San Diego, further pointed out that on and around one mature giant kelp plant over several million organisms can be found to exist. Many of these animals are microscopic, but nonetheless, the tremendous quantity of life is staggering.

The kelp beds are indeed a special place to dive and giant kelp is useful to man in many other ways. Since 1911, when the United States Department of Agriculture sponsored a study of the kelp beds, American industries have sought economic uses of kelp. During World War I kelp was harvested and processed for potash and acetone for use in the munition industry. Soon further research discovered that algin, a colloidal substance that is one of the natural ingredients of kelp, has many commercial uses. Available only from certain sea plants, algin has a strong affinity for water. It is, therefore, extremely useful as a suspending, stabilizing, emulsifying, gel-producing, and film forming additive that has found its way into over 70 commercial products. These include: ice cream, beer, fruit drinks, egg nog, candy, paints, paper sizing, toothpaste, hand lotions, and more. Giant kelp also contains potassium, iodine and several minerals, vitamins and carbohydrates used as food supplements for both animals and humans.

The California Fish and Game Commission now regulates the commercial harvesting of giant kelp. Two companies, Kelco, based in San Diego and Stauffer Chemical, in Port Hueneme, presently harvest and process *Macrocystis*. Ron McPeak explained to me that Kelco cuts and gathers kelp using a fleet of modern seagoing ships which have lawnmower-like racks that are pushed through the top three or four feet of the surface kelp. After cutting, the strands of kelp are collected on large conveyor belts and taken directly to the San Diego plant for processing. The kelp forests not only provide the more than 500 employees at Kelco with a viable way to make a living, but the health of the kelp beds is the key to their economic future. McPeak further pointed out that Kelco demonstrates great concern for the proper maintenance and preservation of the kelp beds by planting young kelp to help re-establish old beds and by creating new beds. Recently, Kelco planted over 35,000 kelp plants near La Jolla, California.

Not too many years ago man's invasion into the kelp forests had placed many areas in great jeopardy. Men, both hunters and trappers, highly valued the pelts of sea otters and hunted those mammals to the point of near extinction. Sea otters on the other hand, prey upon sea urchins which in turn forage upon the holdfasts of giant kelp. The kelp plants quickly perish when the holdfasts are eaten and torn loose from the bottom. With the sea otter population so diminished and nothing to hold the sea urchin populations in check, the urchins rapidly de-





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## CALIFORNIA KELP

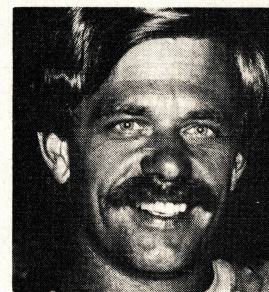
stroyed many kelp beds and numerous species suffered greatly.

Since the early 1960's, with the support and assistance of Kelco and several governmental agencies, the California Institute of Technology implemented a program to refurbish the kelp beds of Southern California. Owing at least in part to their efforts, the overall health of the forests is better today than it has been in many years.

Next time, or perhaps for you it will be the first time, you have the opportunity to make a dive in a California kelp forest, I hope you can enjoy the fact that you are swimming in an ecosystem that is both extremely diversified and whose resources are useful to man in many ways. This habitat is at the same time very delicate and surprisingly vulnerable despite its rather rugged appearance. If exploited without proper concern, the kelp forests are a resourceful habitat that we can destroy in very little time. But, if well maintained, the miles of kelp beds that flourish along the California coast, along with all the inhabitants and resources found within them, should be here for future generations to enjoy. 🐠

## SCHUSTER JOINS MAHO

Gerald Schuster has recently joined the staff of Maho Watersports as aquatics management consultant. He brings



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For more information, write: Maho Watersports, Mullet Bay Beach Hotel, St. Maarten, Netherlands Antilles. 🐠

## PADI TREASURE HUNT

The PADI Training Facilities Association of St. Louis held a treasure hunt September 20-21 at Wildcliff Resort and Campground. The owners of The Dive Shop, Inc. and Inner World Dive Centers offered over \$1,000 in prizes for those divers collecting treasures underwater. The event will be held again next year — contact The Dive Shop for details. 🐠



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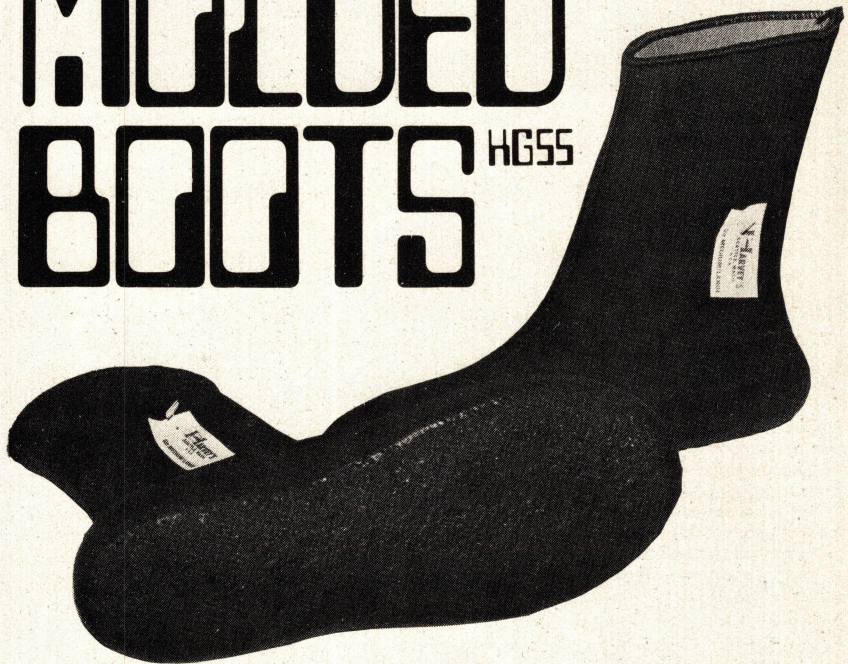
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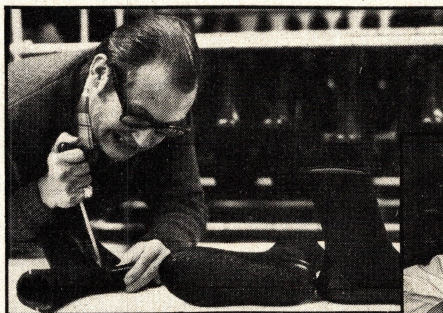
There is no fast way to construct this type of boot. Each pair must be hand molded with patience and skill. At Harvey's we have the skill and patience born from over twenty-five years of experience in the diving business. When you combine this experience with advanced technology you have a creative environment capable of producing a molded sole boot years ahead of its time.

Harvey's research and development department thoroughly tested this boot for thermal protection, abrasion resistance, durability and comfort under not only normal dive conditions but abusive conditions as well. We at Harvey's are convinced of the integrity of this boot. Try a pair and let us convince you.

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## FILM FESTIVALS

(Continued from Page 22)

present the Underwater Film Review. In addition to the latest in dive motion pictures, the Underwater Film Review will feature a 12 unit multi-media slide show produced and presented by Camille Myers and Ron Stephenson of Life Below.

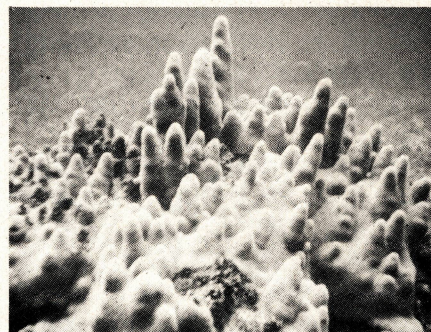
The Speakers Reception will follow the Underwater Film Review at John Hancock Hall's Dorothy Quincy Suite at 10 pm. The underwater audience will have an opportunity to take refreshment and meet and chat with the many celebrities on the program.

Tickets are available in advance (Underwater Symposium \$4, Underwater Film Review \$4.00, Speakers Reception \$7) by writing: Fred Calhoun, P.O. Box 291, Back Bay Annex, Boston, Mass. 02117. ✉

## SEASPACE '81

Houston Underwater Club, Inc. will present Seaspac '81 at the Shamrock Hilton Hotel in Houston, Texas on July 25 & 26. Seaspac has an international underwater photographic contest, film festival, two-day diver symposium and both commercial and educational exhibits.

The photographic contest includes slides, prints and movies. The awards



are specially designed by Robert Straight. Entry deadline is July 6 and judging is on July 10.

The diver symposium will feature outstanding local and nationally known speakers on all subjects of interest to divers. The Saturday evening film festival will present the best underwater movies and slides available.

Information on Seaspac '81, and photo contest entry forms, are available from: Seaspac '81, Houston Underwater Club, P.O. Box 3753, Houston, Texas 77001.

Seaspac will be immediately preceded by the Underwater Society of America's board of governors meeting, July 22-24, also at the Shamrock Hilton. Information on that meeting can be obtained from USA, P.O. Box 513, Christiansted, St. Croix, U.S. Virgin Islands 00820. ✉



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Exceptions include the quartz-driven Omega®, a timepiece that costs over \$325. And the soon to be revealed quartz Rolex®, also at a rather unlovable price.

Well, now The Sharper Image can bring you quartz precision combined with rugged engineering—for a startling \$89. That's the price of our new Windert Sportman, and it's available to you with a free phone call.

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Windert is totally different from traditional mechanical watches. It doesn't rely on springs, balance wheels or any of the fussy moving parts that demand frequent visits to your jeweler.

Its operation is far more ingenious, and also much more reliable. Beneath its dial is a miniature network of electronic circuits, squeezed onto a wafer of silicon; the same microcomputer technology used by even the most expensive solid-state timekeepers.

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Windert is built for rough treatment.

The dial is oversized and deeply set, and well protected by the raised stainless bezel. This same bezel also serves as a rotating 60-minute timer; it lets you clock anything, from your oxygen supply to the minutes on your parking meter.

The crystal is made from thick, tempered glass. It's fitted to the case so tightly, the Sportman can withstand five atmospheres of pressure (enough to take you 165 feet underwater).

And of course, Windert's tight construction also prevents damage from dust, perspiration, extreme temperatures and ordinary moisture.

The entire case and bracelet is machined from 100% stainless steel with a fine brushed finish. Immune to the ravages of salt

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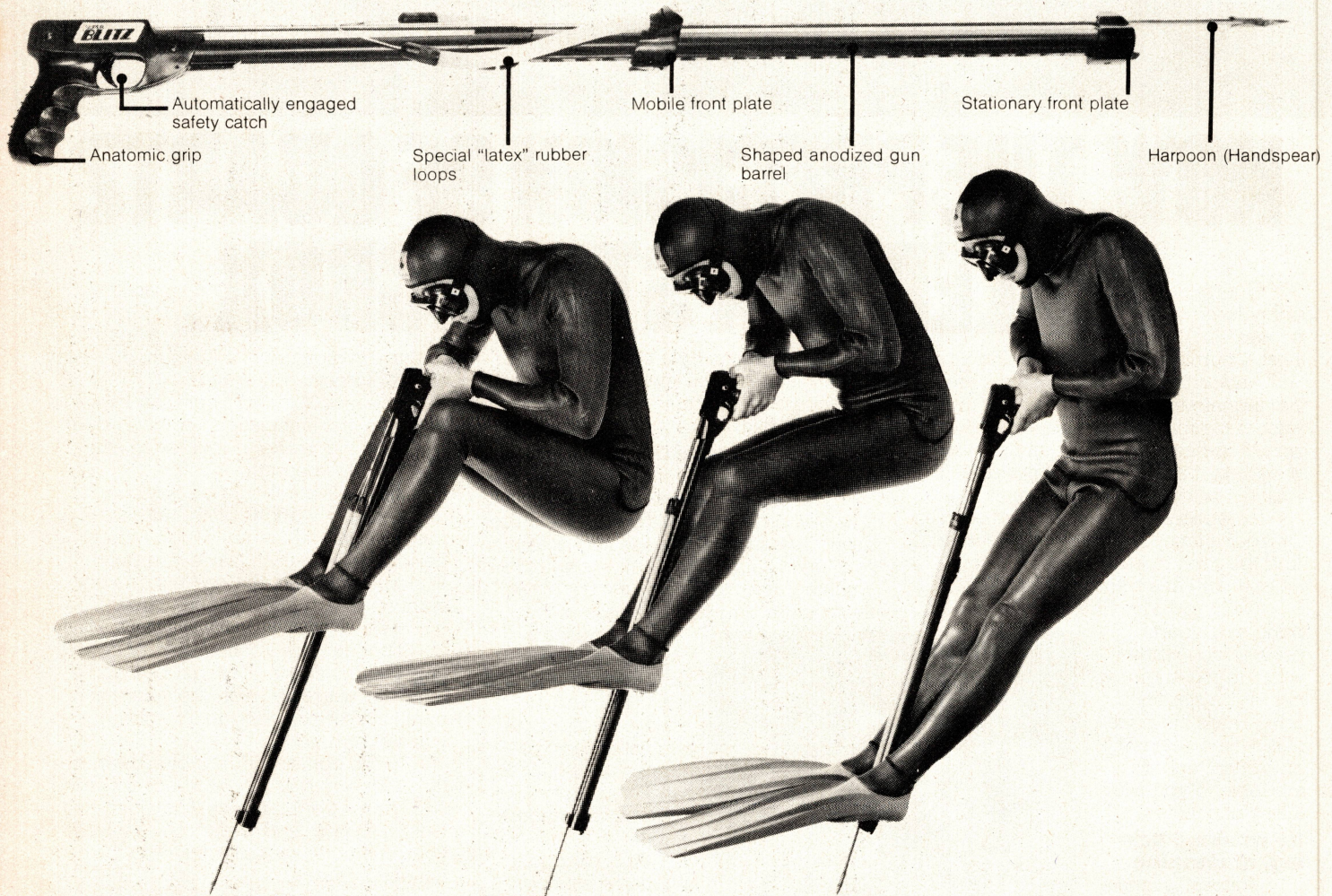


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## SCUBA SAFETY IMPROVES

A dramatic drop in the number of U.S. sport diving fatalities occurred during 1977 and 1978, according to a team of University of Rhode Island researchers. In 1977, 102 deaths were recorded, 25 percent below the average of the previous three years. Fatalities increased slightly to 116 in 1978, 18 percent below the previous three years' average.

The 102 deaths in 1977 marked the lowest number of fatalities since 1970 when URI began its National Underwater Accident Data Center to collect statistics and analyze the causes of deaths. Fatalities reached a high of 147 in 1976, a year in which scuba training activities reached a low in enrollment.

John J. McAniff, the URI diving safety officer who heads the project, attributes the increased safety record to better instruction and equipment. "Training agencies have improved their programs and are including more open water dives. There are more continuing education and specialty courses being offered which keep beginning divers under supervision longer. Manufacturers have also made great advances in equipment design, such as with the buoyancy compensation vests," he explained.

McAniff points out that URI's investigations into scuba fatalities have helped highlight needed improvements in training and equipment. Resulting changes are making diving much safer although, as McAniff says, the current safety record for the sport diving industry is good considering there are between 1.5 and 1.9 million active divers.

More detailed information on the dive fatalities can be found in a report entitled *United States Underwater Diving Fatality Statistics 1970-1978*. The sponsors of this research are the Manned Undersea Science and Technology Office of the National Oceanic and Atmospheric Administration, the U.S. Coast Guard and the National Institute of Occupational Safety and Health. The cost of the report is \$3 (checks should be made out to Scuba Safety). Requests should be sent to Scuba Safety, P.O. Box 68, Kingston, Rhode Island 02881.

## DIT SELLS DIVERS ACADEMY

John W. Manlove, president of Divers Institute of Technology, Inc. (DIT), Seattle, Washington, recently announced that its East Coast school, the Divers Academy of the Eastern Seaboard, Inc., in Camden, New Jersey had been sold. DIT had owned and managed the Divers Academy for the last two years. Under the terms of the sale, DIT is no longer affiliated in any way with the East Coast school.

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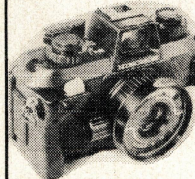
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# ABC ISLANDS

ARUBA

BONAIRE

CURACAO



Skin Diver Magazine  
Special Supplement



# The ABC's of the DUTCH CARIBBEAN

By Paul J. Tzimoulis

**T**he ABC's are a unique cluster of three small islands that hug the coast of Venezuela. They lie in the southern Caribbean 1100 miles southeast of Miami and 2000 miles from New York. Here the weather is always balmy, with sunny days, blue skies and an average temperature of 82°F. And yet, these are not tropical jungle islands, for the climate is arid. Cactus and divi divi trees decorate the landscape, but steady trade winds provide a natural cooling effect. Best of all, the ABC's lie below the "hurricane belt" and are rarely affected by tropical storms or cold fronts from the U.S.

One of the tourism attractions of the ABC's is this group's stable economy and cordial government attitude toward visitors. The ABC's are working hard to develop tourism from the United States and they go out of their way to make Americans feel welcome. The official currency of the ABC's is the guilder — otherwise known as the Netherlands Antilles florin (NAf). The guilder is divided into 100 cents, using the same basic system as the U.S. dollar. The official rate of exchange at the banks is 1.77 guilders for \$1 U.S. Traveler's checks are accepted almost everywhere for purchases at hotels, restaurants and local stores. We also found that U.S. credit cards such as VISA and American Express are widely accepted at the hotels. In fact, we had no trouble at all spending U.S. dollars just about anywhere among these islands.

Aruba, Bonaire and Curacao are different from most other islands in the Caribbean for they are of Dutch descent. Once an overseas colony, the ABC's are now part of the Netherland Antilles and share equal political status with their former motherland — Holland. The Dutch influence is visible everywhere, from gingerbread architecture to the flavorful

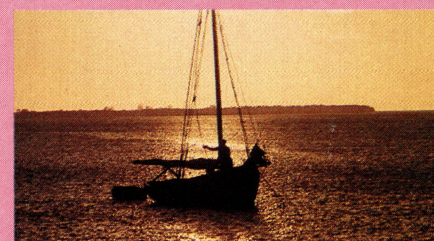
blend of Dutch/Indonesian cuisine. The people of these islands are extremely friendly, cordial toward American visitors and remarkably multi-lingual. While Dutch is the official language, practically everyone speaks English and Spanish fluently as well.

Though the ABC's lie clear across the Caribbean, almost touching South America, they are very easy to reach. ALM Antillean Airlines operates non-stop jet service from Miami to both Aruba and Curacao. And on Saturdays, ALM provides non-stop jet service direct to Bonaire. The airline also provides frequent inter-island service between the three islands. American Airlines provides daily jet service from New York to both Aruba and Curacao.

Of the three, one island in particular has built a worldwide reputation for outstanding diving. The beauty of its living coral reefs and remarkable array of marine life have attracted dive enthusiasts from the world over. Bonaire's prominence in the dive world has been so strong that it has literally overshadowed its two neighbors. And yet, Aruba and Curacao offer good diving as well. While their underwater reefs may not equal those of Bonaire, these two islands offer better quality diving than can be found in 50 percent of the Caribbean. In some ways, Aruba and Curacao offer a different kind of diving not found in Bonaire and thus complementary to their popular neighbor. It would be wise for the visitor planning to travel all the way to the ABC's to consider a side trip to the neighboring islands. This would cost just a little more, but would provide a valuable opportunity to sample a slightly different island flavor. The visitor who does this would be rewarded with a more rounded vacation in the Dutch Caribbean.



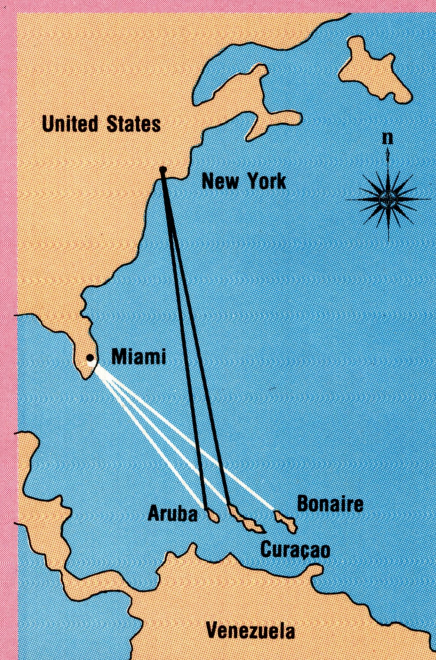
Aruba windmill



Bonaire sunset



ALM Antillean Airlines



Air routes to the ABC's



# ARUBA

**A**ruba (rhymes with scuba) is like a shiny new silver dollar. This island is the picture of prosperity. It has a modern jet airport, beautifully paved highways and ultra-modern high rise hotels. Although Aruba is the smallest of the ABC's, it hosts more tourists annually than the other two islands combined. Its three major industries include: an oil refinery, (seventh largest in the world); a booming winter resort business; and legalized gambling. It is sort of a miniaturized Las Vegas — with the added attractions of magnificent white sand beaches and the blue Caribbean sea. This island is definitely for the young at heart who want to dance, dine and gamble all night — swimming, sunbathing, and sleeping during the day.

Aruba's hotel and resort facilities fall

into two categories — the small and the mighty. The big five are a group of giant high rise pleasure palaces situated in a row along Palm Beach — Aruba's swank hotel row. These shimmering monoliths range in size from 200 to 500 rooms each and provide every vacation service imaginable; From health centers and tennis courts to disco night clubs and elegant dining rooms. The big five include: The Americana, Aruba Caribbean, Concord, Sheraton, and the Holiday Inn.

On the other hand, if you have an aversion to lively crowds and wild night life, you may want to seek a more intimate resort hotel among Aruba's fine selection of small and middle sized resorts. Beach hotels such as the Manchebo, the Divi Divi, and the Tamarijn range in size from 60 to 150 rooms. SDM found the Talk of the Town to be a delightful choice since it is located close to the airport and the beach and only a

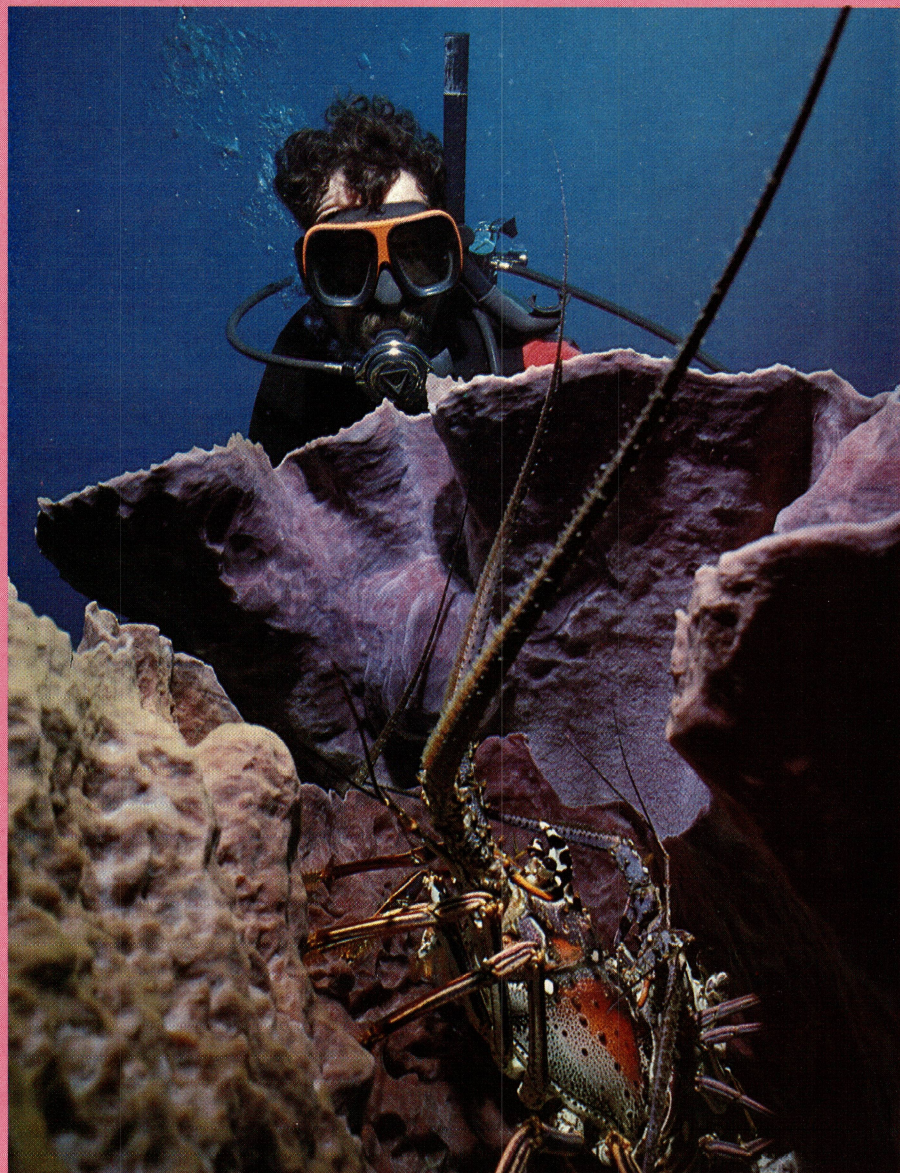
short ride from town. This fine hotel has 64 rooms grouped in courtyard fashion around a swimming pool and boasting an absolutely superb restaurant for candlelight dinners.

The thing that makes Aruba so lively is its five gambling casinos. These provide the super hype of 24 hour gambling action. The island also has an assortment of 25 different restaurants with a wide range of cuisine. There is also a growing number of night clubs and discos which offer entertainment into the wee hours of the morning.

As for the diving, Aruba has been largely overlooked by most experienced divers. It is a real sleeper and could be one of the big surprises of the Caribbean.

At present Aruba has only one dive operation, but it is well stocked and growing larger every year. Subsea Safaris is located at the edge of the beach next door to the Aruba Sheraton Hotel.

**Photography by Geri Murphy**



**Lobsters in a sponge at California Pt.**

TRAVEL DATA	
Location	— 42 miles west of Curacao 86 miles west of Bonaire 15 miles north of Venezuela
Size	— 20 miles long, 6 miles wide
Population	— 62,788
Languages	— Dutch, Papiamentu, English and Spanish
Currency	— Officially Guilders (NA Florins), but U.S. dollars accepted widely
Electricity	— 120 volts AC/60 cycles
Hotels	— 11
Airfield	— 9000 ft. jet port
Visitor Entry	— For U.S. citizens: passport, birth certificate, or voter's card
Tourist Info	— Aruba Tourist Bureau 1270 Ave. of the Americas Suite 2212 NY, NY 10020 (212) 246-3030

This facility caters primarily to tourists and non-diving hotel guests who want to learn how to snorkel or scuba and perhaps make a few shallow dives on nearby coral reefs. Daily dive boat trips carry an assortment of beginners, scuba students, on-looking non-divers and perhaps an occasional veteran diver who just wants to get wet.

Because this dive operation has had to make a living from the tourist business, it has offered very little excitement for the experienced diver and veteran Caribbean diver. However, the management of Subsea Safaris is well aware of experienced divers' needs and is presently working hard to develop special reef trips for them. Anton Segers and Peter Creutzbert are both commercial divers who have slowly been building up their business to the point where they can accommodate the more serious minded diver.

Because of the limited scuba facilities and lack of reef trips for experienced divers, Aruba has been unfairly branded as an island with poor diving. In truth, Aruba has some rather good coral reef sites at the north and the south of the Palm Beach area. Aruba diving can be



# A R U B A



Only four hours from New York, just two and a half from Miami is one refreshingly happy, prosperous island with endless white beaches, international cuisines, alluring shops, casinos and nightlife.

The island with the Dutch Heritage and Latin warmth that speaks perfect English, shouts out its own language's most-used expression: "Bonbini!" Welcome!

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# ARUBA

excellent if the visitor can get to these more distant areas where the visibility is better and the reefs much more exciting.

At present, Aruba's major dive attraction is a German steel freighter known as the **Antilia Wreck**. This 400 foot long hulk was the first casualty of WW II and now lies in 55 feet of water off Malmok Beach. The ship was deliberately scuttled in 1940 to avoid capture and confiscation by the Dutch Marines. During the subsequent 40 years of saltwater submersion, this big wreck has attracted a marvelous assortment of macro marine life, corals and fish. The wreck is overgrown with yellow/orange cup corals, banded coral shrimp, arrowcrabs and other small creatures. Cruising among the wreckage are yellowtail snappers, grouper, trumpetfish, filefish and rays. Underwater visibility averages 60 feet,

covers the tiny coral polyps are actively feeding. Their outstretched tentacles capture drifting larvae, tiny fish fry and an occasional juvenile squid which may accidentally bump into the corals' fly trap feeding mechanism. All through the night, a life and death struggle is carried on between these predatory corals and their hapless victims.

The *Antilia Wreck* also attracts a tremendous amount of fish life which can be an absolute delight for both the fish watcher and the close-up underwater photographer. On just one dive I counted no less than ten different boxfish hovering around the wreck like tiny dirigibles. Perhaps the most amazing discovery was a small pufferfish that was actually lying in a bed of cup corals. The outstretched tentacles of the *Tubastraea* polyps camouflaged most of this creature's body and allowed him to rest quietly and await the delivery of some drifting morsel of food.

Still another nighttime phenomena of the wreck are the many lobsters and crabs which make their nocturnal ap-

pearances. Our dive guide, Alvin Clemencia, pointed out no less than eight jeweled lobsters on just one dive. This species of lobster is much smaller and more colorful than the normal spiny lobster that is caught for food. The lobsters we encountered ranged in size from four to eight inches, and did not appear especially frightened by scuba divers. Their bodies were covered with brightly colored spots which sparkled under the dive light beam like shiny sequins on a disco dress. We also found and photographed a wide variety of other crustaceans including small hermit crabs, red coral crabs, arrowcrabs, and banded coral shrimp. The *Antilia Wreck* is worth at least one night dive.

One of the most challenging dives in Aruba is a trip to the reefs off California Point. This spot is at the very northern tip of the island and is named after a ship called the **California** that was wrecked there during a storm. The bottom terrain is flat, with low profile sponges and corals and an occasional high coral head. Dive depths range from 60 to 95 feet, and

DIVE OPERATOR	
Name	— Subsea Safaris
Address	— Argentina Street 15 Oranjestad, Aruba, N.A.
Location	— On the beach next to the Sheraton Hotel, Palm Beach area
Telephone	— 23900, extension 917 24617 (home/evenings)
Owner	— Anton Segers
Compressor	— RIX 17cfm
Rental Tanks	— 70 steel 72's
Boats	— 36 ft. custom barge/20 divers 36 ft. custom barge/35 divers
U.S. Agent	— Aruba Tourist Bureau 1270 Ave. of the Americas Suite 2212 NY, NY 10020 (212) 246-3030

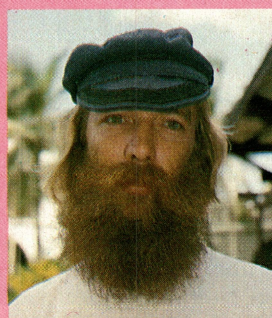
but the wreck is a gold mine for the macro photographer. It is also an exciting location for night diving and Subsea Safaris conducts at least one night trip weekly.

While daytime diving on the *Antilia Wreck* is just average, a nighttime visit can prove exhilarating. The giant shipwreck is transformed into a carnival of color with at least one-half dozen side-shows that will fascinate even the most experienced diver. It is an entirely different world at night where the natural struggle for survival is intensified and often illuminated by the diver's light.

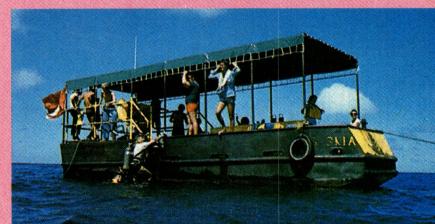
Much of the color transformation is due to the thousands of cup corals (*Tubastraea*) which grow on the wreck. During the day these corals retract their polyps into drab and dull limestone cups and hide from marauding reef fish. At night, when the fish are sleeping, these corals extend their brilliant yellow/orange tentacles and the wreck is ablaze with vivid color. Certain portions of the shipwreck are literally covered with *Tubastraea* and divers will find a six foot wall of yellow polyps. On closer examination one dis-



Puffer in cup corals



Anton Segers



SubSea Safaris' dive boat



Antilia Wreck



Talk of the Town Hotel





# ARUBA

there is a swift running current which ranges from one-half to one knot. The most predominant marine life in this area is the sponges. The bottom is literally covered with sponges of all shapes and colors. The most noticeable is a species of sponges shaped much like a giant clam. It ranges in size from two to five feet long and in colors from gray to light brown. There are also many small orange sponges the size of basketballs as well as large purple tube sponges. My dive guide, Emile Weststrate, pointed out a family of four lobsters huddled inside one sponge. It was one of the most exciting dive experiences of my visit.

Off the southern tip of Aruba is a very beautiful coral reef called Baby Lagoon. Starting in 15 feet of water a veritable forest of elkhorn and giant staghorn corals slope down to a depth of 60 feet. The bottom is literally covered with tightly packed corals of all sizes, shapes and species. Further offshore is a second reef which is loaded with sponges, fish and other assorted marine life. This reef ranges in depth from 60 to 100 feet or better.

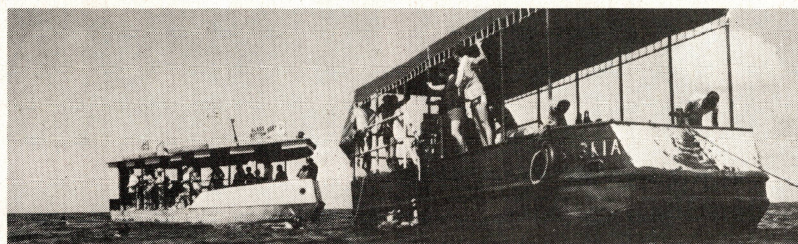
Another good dive spot midway along the south coast is a place called Pos Chiquito. Approximately one-half mile off-

shore there is a deep reef running from 60 to 100 feet. This reef is loaded with large sponges, beautiful coral formations, towering seaweeds and all types of reef fish. Visibility can range from 80 to 120 feet, depending on the currents.

Still another excellent dive area off the south coast is a place called Barcadera, fairly close to Aruba's industrial harbor. Located one-half mile offshore is a double reef with dive depths ranging from 60 to 120 feet. These mammoth coral formations are thick with purple tube sponges, orange basket sponges, yellow tube sponges, gorgonians and stony corals of all kinds. There is quite a bit of fish activity and lots of barracuda in the area. Underwater visibility in this area ranges between 80 and 100 feet.

Unfortunately, most of Aruba's good dive locations are located a long way from Palm Beach and Hotel Row. Up until now, it has been very difficult to reach these locations by boat because of the long sailing time required. However, Subsea Safaris is about to change the situation. Owner/manager Anton Segers has advised SKIN DIVER that he is in the process of refitting a second dive boat which will be berthed somewhere along the south coast and therefore able to conveniently reach the better dive reefs. The advent of this new service may very well change Aruba's image for the experienced diver.

## ARUBA! Exciting Dive Destination



Besides being one of the most continental islands in the Caribbean, Aruba has excellent diving. Abundant fish life, lush coral formations and the wreck of the Antilia; all make for superb diving.

The full service dive shop, Subsea Safaris, is located on the lee of the island only 15 minutes from town and the modern airport.

For complete information on reservations, watersports, sight-seeing tours, casinos and everything you need to know about Aruba, write airmail to:



**De Palm Tours, L.G. Smith Blvd.,  
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Anton Segers



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## Aruba



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# BONAIRE

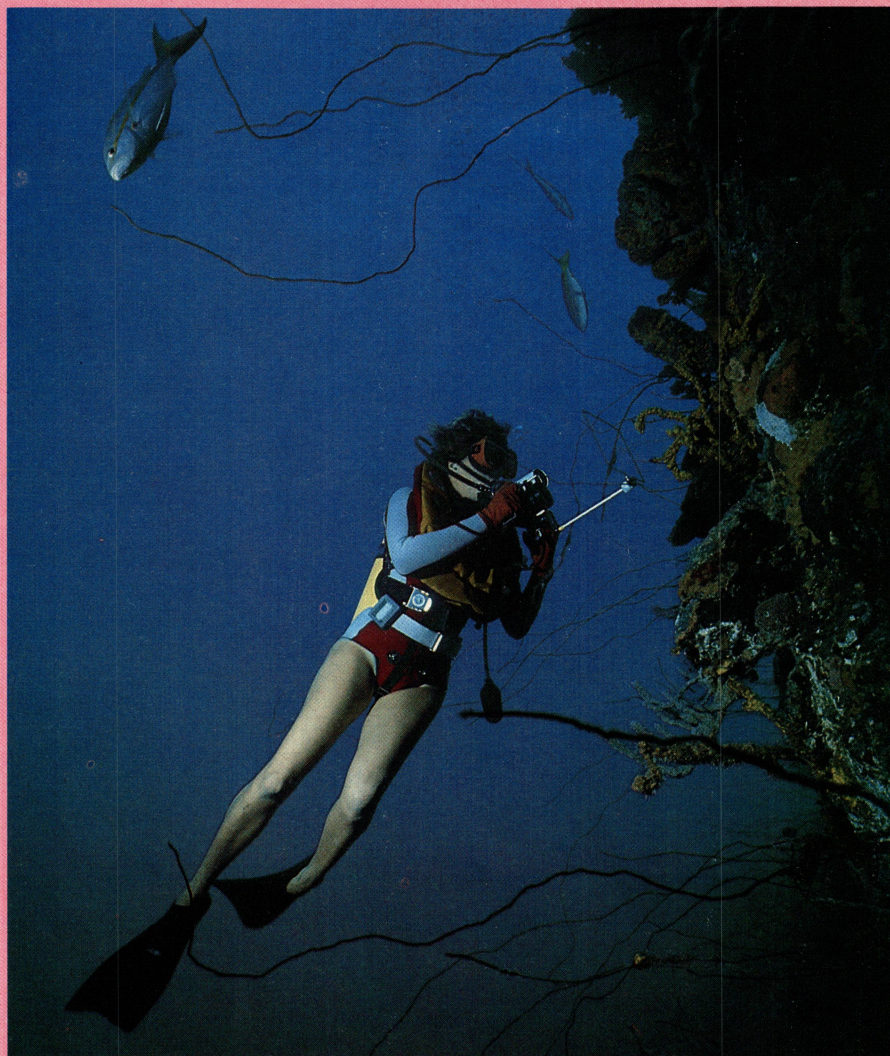
**B**onaire (pronounced Bon'-air) is the least developed of the ABC's. It has the smallest population, only four hotels and virtually miles of untouched land and virgin beaches. It is the last remaining frontier of natural island wilderness. In fact, the very name of this island denotes "good air" or "fresh air."

A visit to Bonaire is like going out into the countryside, for the coastline road meanders through a scenic paradise that usually appears only on picture postcards. On one side there is the blue Caribbean with forests of elkhorn and staghorn corals nestled up against the shoreline. On the other side there is a fascinating wilderness filled with island foliage, wild parrots, iguanas and even a herd of wild donkeys. Located at the north end of Bonaire is Washington National Park — a government protected sanctuary for over 130 species of birds, some of them quite rare. At the southern end of the island you can watch great flocks of pink flamingos nest and feed in the salt lakes and marshes.

For divers, Bonaire is something entirely different. Today, this island is regarded as a mecca for vacationing scuba enthusiasts who seek the most beautiful of coral reefs, amazingly abundant marine life, and a style of resort diving which is irresistible. Bonaire is rated among the top five resort dive destinations in the entire Caribbean and its reputation has spread worldwide. Because of its remarkable beauty, underwater photographers and movie makers are flocking to this small island by the hundreds.

While Bonaire may have comparatively few hotels, practically every one of them caters to visiting divers. Diving tourism is the island's number one attraction and each hotel has gone out of its way to provide specialized services which would attract vacationing divers. Every hotel on Bonaire is within close proximity of the water and located on the west side where the waters are calm and the diving is best.

The Flamingo Beach Hotel is by far the most popular dive hotel on Bonaire and may very well be the most popular in the Caribbean. This resort facility has recently been rebuilt and expanded in both size and services. There are now a total of 110 rooms, two very good restaurants, two cocktail lounges, a swimming pool, a jacuzzi and an assortment of shops and offices. Today, the Flamingo Beach Hotel resembles a complete and self-sufficient diver's village, with its own sidewalk system and social activities. There is happy hour at the terrace bar every afternoon, special barbecues and buffet dinners on selected nights and outdoor film and slide



Dee Scarr photographing sponges at Carl's Hill

TRAVEL DATA	
Location	— 30 miles east of Curacao — 86 miles east of Aruba — 50 miles north of Venezuela
Size	— 24 miles long, 3 to 7 miles wide
Population	— 8933
Languages	— Dutch, Papiamentu, English, Spanish
Currency	— Guilders (NA Florins) or U.S. dollars
Electricity	— 127 volts AC/50 cycles
Hotels	— Four
Airfield	— 8100 ft. jet port with new terminal
Visitor Entry	— For U.S. citizens: passport or birth certificate or voter's card
Tourist Info	— Bonaire Tourist Office 685 Fifth Avenue NY, NY 10022 (212) 838-1797

presentations by noted dive experts.

Most important of course, is that the Flamingo Beach Hotel is home and headquarters for Dive Bonaire, the largest resort dive operation in the ABC islands. Owned and operated by Peter & Alice Hughes, this well orchestrated resort dive operation employs a staff of 14 divers and hosts over 3000 divers annually. Dive Bonaire maintains a fleet of six dive boats, including four Flattops, a fast running reef cruiser and a large glass bottom craft. There is also a 15 passenger mini-bus for beach diving excursions. At present, Dive Bonaire

can accommodate up to 120 divers a day and still not seem crowded.

The newest addition to the Dive Bonaire facility is a small but complete facility designed for the visiting underwater photographer or the diver who wants to learn a little bit about taking pictures. This facility includes a custom color lab (E-6 Unicolor processing), an underwater camera rental department and a classroom for photo lectures. The photo center is being managed by Dee Scarr, a well known resort dive guide and underwater photographer.

The Flamingo Beach Hotel and Dive Bonaire cater to a wide variety of dive guests. They provide individualized services for the scuba diver who is traveling alone, offer scuba instruction for the non-diver who wants to learn, and provide complete facilities and services for dive groups ranging in size from 7 to 70.

The Hotel Bonaire is one of the island's oldest and largest hotels. This is a large sprawling facility situated on some of the finest shore front property in all of Bonaire. This facility consists of 145 rooms, two tennis courts, a miniature



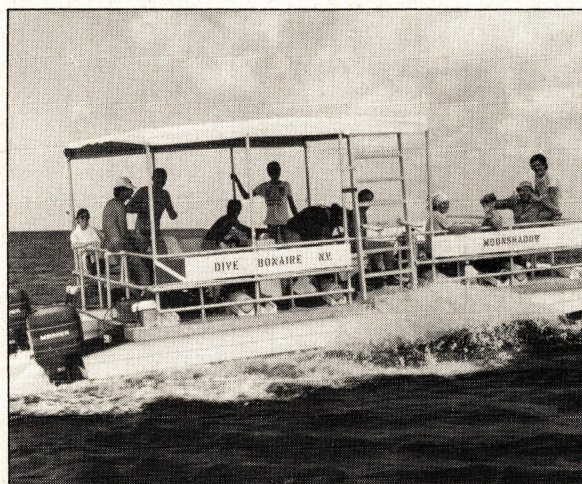
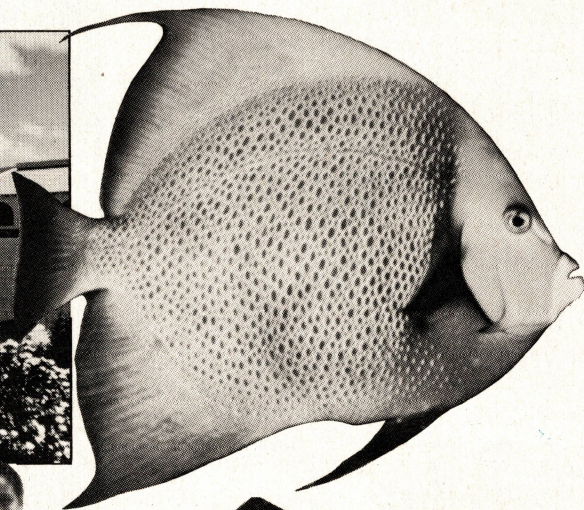
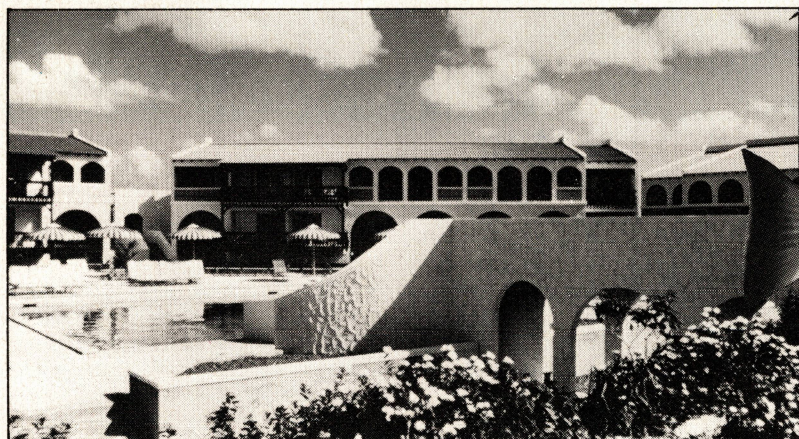
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# BONAIRE

golf range, a restaurant and a cocktail lounge. The Hotel Bonaire possesses two things which distinguish it from the rest of the hotels — a really beautiful sand beach for sun bathing and swimming, plus the island's only gambling casino. This hotel has recently changed management and is presently undergoing renovation to upgrade its facilities.

The Hotel Bonaire is the home of a newly formed dive operation called the Bonaire Scuba Center. This is owned and managed by three partners — Ady Everts, Eddie Statia, and Al Catalfumo. Ady and Eddie are well known Bonairian underwater guides who have at least ten years experience in the business. Al is the silent partner who owns and operates a highly successful New Jersey dive store known as Divers Cove.

Headquarters for the Bonaire Scuba Center is located right on the beach at the Hotel Bonaire. The center employs a staff of seven people and operates from three Flattop boats. One of the main attractions of the Hotel Bonaire is unlimited beach diving on well known Porch Reef, located directly in front of the dive shop.

The Hotel Bonaire and Bonaire Scuba Center intend to cater to both individual divers and small dive groups ranging in size from 10 to 30 divers.

Cap'n Don's Habitat is an extremely unique dive resort designed for the experienced diver/nature person. This remarkable facility has been designed and built almost single-handedly by Captain Don Stewart, Bonaire's oldest and most celebrated underwater guide.

The Habitat is a combination hotel and dive center. The theme of the sea has been carried throughout the entire design motif of the rooms, dining area, cocktail lounge and dive boutique. It is the culmination of a master dive guide's 15 years of resort experience and imaginative dreams.

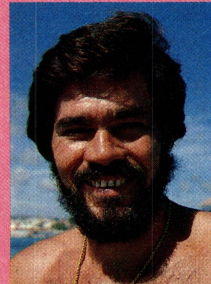
The Habitat facility is composed of 30 rooms, divided into 11 bungalows on a beautifully landscaped garden area. The resort can hold up to 52 guests and the accommodations range from two bedroom efficiency cottages to very inexpensive economy rooms known as "monk cells." The complex sits on the edge of a coral bluff overlooking the Caribbean and there are several coral reefs directly in front of the hotel. The center includes a dining area, cocktail lounge and general store. Further along the coral bluff is a well designed dive shop which includes three air compressors, a healthy assortment of scuba tanks, repair shop and rental department. The Habitat operates three Flattop dive boats and a smaller craft for snorkelers. The Habitat is a small, all-divers

resort with an informal atmosphere. It caters specifically to experienced divers.

The Carib Inn is a small guest house and one-man dive operation. Located on the shore, almost next door to the Flamingo Beach Hotel, this small but efficient dive operation is the brainchild of Bruce Bowker.

The Carib Inn guest house is a two-story beach front house that has been converted into five guest rooms, of which four are air-conditioned. Two of the rooms are located upstairs with a

lovely view of the sea and a wide front porch. The other three are located downstairs, adjacent to a small swimming pool and courtyard. Also located on the property is a small but very neat dive shop containing an air compressor, scuba tanks, and a full repair shop. This guest house can accommodate up to 12 people and offers a very quiet and personal atmosphere. Meals and drinks are not served at the Carib Inn but guests will find excellent dining at the two restaurants next door in the Flamingo Beach Hotel complex. Also it is



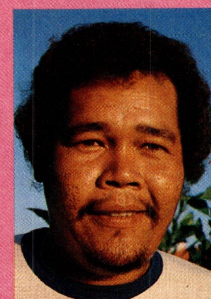
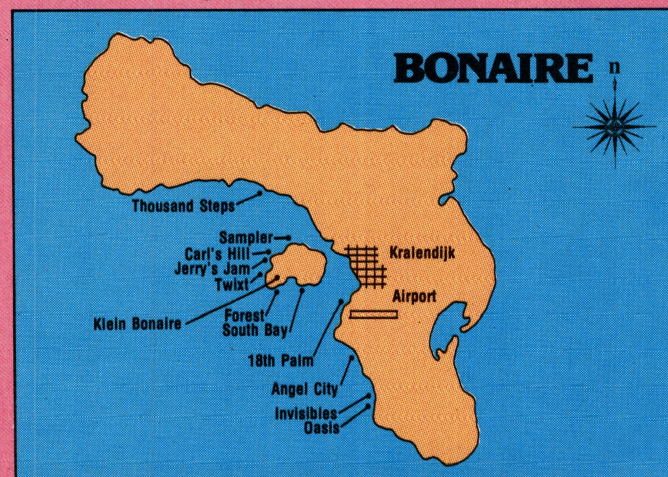
Peter Hughes



Flamingo Beach Hotel



Dive boats heading for Klein Bonaire



Ady Everts



Eddie Statia



Hotel Bonaire beach



# BONAIRE

only a short walk to town, where several other excellent restaurants are located.

Bruce operates a 24 foot utility runabout which will cruise at 28 mph. This fast and comfortable dive boat will carry up to 12 divers and makes two dive trips daily. Bruce tries to make all of his dive excursions extremely personalized and devotes a great deal of attention to each and every one of his guests. If the boat

is not full, Bruce will accommodate divers who may be staying at other Bonaire hotels or aboard visiting yachts.

Bonaire's popularity as a dive destination is primarily owing to the remarkable ease and convenience with which diving can be done. The best reefs lie off the western side of the island, within close proximity of the hotels and within the protected lee of the perpetual trade winds. Here, you will find the sea is calm; both surge and current are almost absent. It is almost bathtub diving, with water temperatures ranging between 80

and 82 degrees.

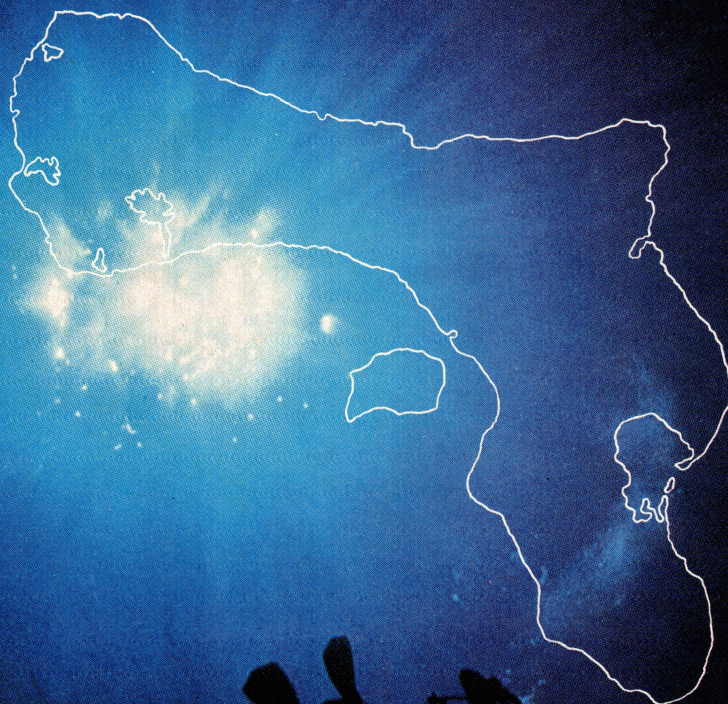
Many of the dive sites lie right at the diver's doorstep: Guests can find healthy coral reefs and a fascinating array of marine creatures right in front of their hotels. In fact, many of Bonaire's dive operators boast of unlimited beach dives which can be done either day or night. On almost any given night one can observe the flashing beams of submerged dive lights marking the progress of a group of divers moving along the reef. With dive depths ranging from 20 to 80 feet, Bonaire visitors find that they have longer and more enjoyable dives, as well as more frequent repetitive dives.

The natural geography of this island makes it an ideal location for resort diving. Bonaire is basically the tip of a submerged mountain peak which never quite sank beneath the surface of the Caribbean. The sides of this mountain peak slope steeply into the Caribbean abyss and provide a unique opportunity to dive close to the shore. Bonaire is virtually ringed by a ribbon of fringing coral reefs — literally miles of elkhorn

# BONAIRE

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## DIVE OPERATORS

Name — **Bonaire Scuba Center**  
Address — Hotel Bonaire  
Kralendijk, Bonaire, N.A.  
Location — Hotel Bonaire beach  
Telephone — 8448  
Owners — Ady Everts, Eddie Statia,  
Al Catalfumo

Compressors — Two Mako 15cfm  
Rental Tanks — 80 steel & aluminum  
Boats — 34 ft. Flattop/24 divers  
26 ft. Flattop/16 divers  
20 ft. Flattop/8 divers

U.S. Agent — Bonaire Tours Inc.  
100 Parker Street  
Morgan, NJ  
(201) 566-8866

Name — **Cap'n Don's Habitat**  
Address — Kralendijk, Bonaire, N.A.  
Location — Habitat Hotel shoreline  
Telephone — 8290 or 8913  
Owner — Capt. Don Stewart  
Compressor — Three Mako 16cfm,  
One Ingersoll-Rand 6cfm  
Rental Tanks — 110 steel 72's  
Boats — Three 26 ft. Flattops/12 divers  
One 19 ft. sled/8 divers  
U.S. Agent — **Aquaventure International**  
P.O. Box 237  
Waitsfield, VT 05673  
(802) 583-3158

Name — **Carib Inn**  
Address — P.O. Box 68  
Kralendijk, Bonaire, N.A.  
Location — J.A. Abraham Blvd.  
Telephone — 8819  
Owner — Bruce Bowker  
Compressor — Ingersoll-Rand 15cfm  
Rental Tanks — 30 aluminum  
Boat — 24 ft. Seaward/12 divers  
U.S. Agent — Direct

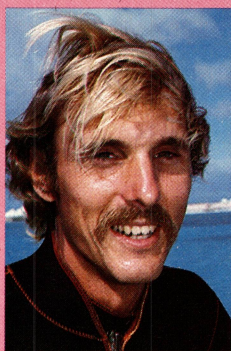
Name — **Dive Bonaire**  
Address — Flamingo Beach Hotel  
Kralendijk, Bonaire, N.A.  
Telephone — 8285  
Owners — Peter & Alice Hughes  
Compressor — Two Bauer 17cfm  
One Mako 15cfm  
Rental Tanks — 120 aluminum  
Boats — Four 26 ft. Flattops/16 divers  
31 ft. Reef Cruiser/10 divers  
32 ft. Glassbottom/15 divers  
34 ft. Flattop/24 divers  
U.S. Agent — Flamingo Beach Hotel  
P.O. Box 686  
Ithaca, NY 14850  
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and staghorn corals form an underwater band that encircles the island. Some of the best reefs are only a stone's throw from shore and most certainly an easy swim for even the most novice of divers.

The underwater reefs of Bonaire excel in beauty. Few islands offer such an incredible selection of sponges, hard corals, reef fish and macro creatures. These reefs are a veritable supermarket of undersea life which constantly amaze and amuse visiting divers. For example, Bonaire undoubtedly has some of the largest and most prolific purple tube sponges to be found anywhere in the Caribbean. A cluster formation may include 50 to 60 separate tubes ranging in length from three to six feet. Orange elephant ear sponges can be found in a variety of familiar shapes ranging from chairs to chalices, and some as large as bathtubs. Iridescent azure sponges sprout like mushrooms and can be seen by the hundreds. Best of all is the myriad of small and sometimes rare macro creatures that abound on these reefs. Arrowcrabs and coral shrimp are in the legions while the more rare gold spotted eels and chain morays appear almost common.

Diving in Bonaire is basically divided into two categories — beach diving and boat diving. There are perhaps 50 dif-



**Bruce Bowker**



**Carib Inn**

ferent beach diving sites which have been located, charted and named. They range from six miles north to six miles south of town. Visitors can either sign up for the scheduled beach dives which are conducted by van or truck, or rent their own cars and make a dive at one of the sites designated safe and well marked. Beach diving along the shores of Bonaire is exceptionally good and in fact better than much of the diving found in other parts of the Caribbean. Underwater visibility can range from 60 to 100 feet depending on the dive site and weather conditions at the time. As good as the beach diving is, Bonaire's boat diving is even better. In fact, boat trips have now become the most popular form of resort diving on this island, with a



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## BONAIRE

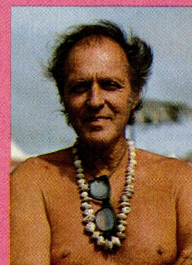
total combined dive boat fleet now numbering 14 crafts.

The destination for most dive boat trips is the small offshore island of Klein Bonaire. It lies approximately one mile off Kralendijk, within easy access of all four dive operators. Klein Bonaire is an uninhabited island which is just far enough offshore to remain unaffected by harbor activities, wave action or any other form of shore influence. The waters around Klein Bonaire are usually clearer than those found along the shore of Bonaire and the reef life appears to be a little more dramatic. At present, 13 different dive sites around Klein Bonaire have been found and named. These include such legendary spots as: Ebo's Reef, Twixt, Carl's Hill, Knife, Sampler, Forest, etc. It seems as though there is another dive site every 100 yards along this island's perimeter and each one offers an entirely different reef profile. At some locations the coral slopes are gentle, while at others they slant downward steeply at almost a 75 degree angle. At Carl's Hill, for example, there is a short vertical wall loaded with corals and sponges. Ebo's Reef features a giant orange sponge six feet tall and shaped like a high overstuffed chair. Perched along the rim of this sponge are no less than 16 black and white crinoids. At Twixt there are hundreds of translucent azure sponges growing in depths from 20 to 70 feet. Some of these sponge formations are extraordinary in size and one that we found has sprouted a cluster of 12 separate tubes. Forest has been named for its thick stand of black coral trees. There are an estimated 100 separate black coral colonies growing along a coral slope in depths from 50 to 130 feet. It truly looks like an underwater forest of small Christmas trees. Jerry's Jam has two small coral caves in shallow water and an unusual purple tube formation further down the slope at

80 feet. This tube sponge consists of 12, four foot long purple tubes arranged in a circular formation, all pointing upward toward the sun. South Bay has both a very healthy coral reef and a tremendous amount of fish activity. On just one dive we encountered a cowfish nestled in a basket sponge, a pair of scrawled filefish cruising among the seaweeds and one of the friendliest moray eels a diver could ever meet.

In addition to the superb boat diving found off Klein Bonaire, there are many other boat trips conducted both north and south of the hotel area. Boat dives are frequently made to Bonaire shore sites which are inaccessible from the beach. This is especially true of some of the sites south of town, such as the Invisibles, Angel City, English Gardens, and Oasis.

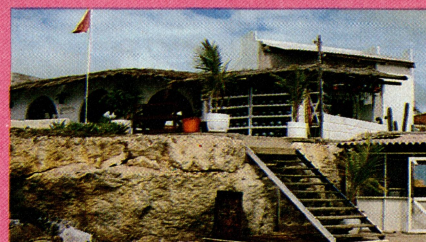
The variety of dive sites and extraordinary array of marine creatures has indeed helped to make Bonaire one of the top dive destinations in the Caribbean. It certainly cannot be completely seen or enjoyed in just one visit and that is why Bonaire does a high repeat business: Visitors return for a second, third and fourth time.



Cap'n Don



Habitat bungalow



Habitat dive shop

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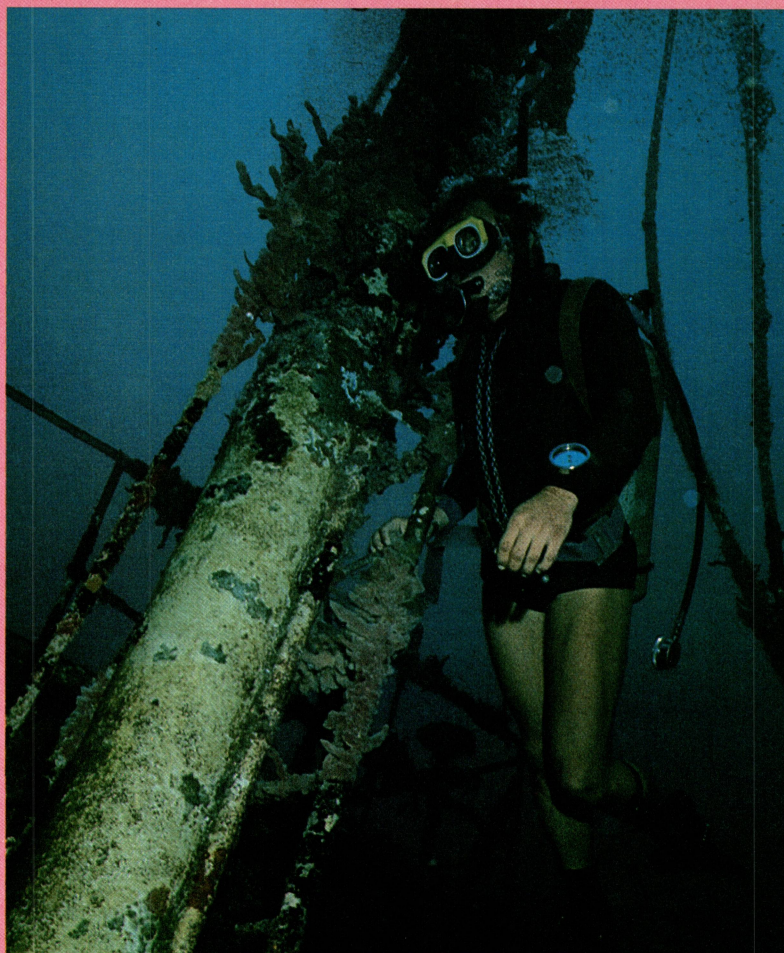
# CURAÇAO

**C**uracao (pronounced Cure'-a-sow) is a picturesque sampling of old world culture. It is the oldest Dutch settlement in the western hemisphere, dating back as far as 1634.

Willemstad, the capital of Curacao, appears to be a little piece of Holland transplanted to the Caribbean. The waterfront is as pretty as a picture postcard, with neatly arranged Dutch style houses that look like part of old Amsterdam. It is a huge city with a busy deep water port for commercial shipping and a resident population of 140,000.

For the tourist Curacao represents an exciting opportunity for sight-seeing, shopping and evening dining. There are a dozen or more major historical sites and landmarks within the city, including the tallest bridge in the Caribbean, the oldest synagogue in the western hemisphere, the famous Amstel beer brewery, the Curacao Liqueur factory and the downtown free port shopping district.

The Curacao Hilton is considered one of the most fashionable hotels in all of Curacao. Its high-rise facade contains 200 rooms and has one of the nicest beach front locations on the entire island. It is approximately two miles from the center of Willemstad, affording convenient access to the downtown activi-

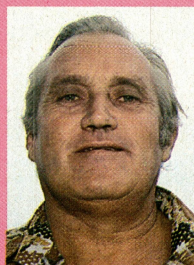


**Divemaster Arnold de Leister on the Superior Wreck**

TRAVEL DATA	
Location	— 42 miles east of Aruba 30 miles west of Bonaire 35 miles north of Venezuela
Size	— 38 miles long, 2 to 7 miles wide
Population	— 159,072
Languages	— Papiamentu, Dutch, English and Spanish
Currency	— Guilders (N.A. Florins), but U.S. dollars accepted widely.
Electricity	— 110 to 130 volts AC/50 cycles
Hotels	— 12
Airfield	— 11,155 ft. jet port, longest in Caribbean
Visitor Entry	— For U.S. citizens: passport or birth certificate or voter's card
Tourist Info	— Curacao Tourist Board 685 Fifth Avenue NY, NY 10022 (212) 751-8266

ties, and a reasonable distance from Curacao's best reefs.

The Curacao Hilton has just about everything a visitor could want. All of the rooms are air-conditioned and have a balcony with an ocean view. The hotel complex includes a shopping mall with drugstore, barber shop, newsstand, boutique, beauty shop and car rental. There is a very large freshwater swimming pool, a health club and a sand beach with an enclosed swimming area. There is a coffee shop, evening dining room, cocktail lounge and a gambling casino right in the hotel. For the outdoor sportsman, there are two tennis courts, shuffleboard and golf privileges at a nearby course. It is a first class operation.



**Ben & Eva van Dalen**



**Piscadera dive boat**



**Curacao Hilton**



**Piscadera Watersports**

Piscadera Watersports is the diving/sailing/swimming concession at the Curacao Hilton. Located right on the hotel pier, this multi-faceted company is owned and operated by Ben and Eva van Dalen. Ben is an old-time scuba diver with more than 20 years of experience. He has made his love into a business. This operation consists of a staff

of four people, with Eva managing the store and two dive guides making daily diving and fishing excursions to nearby reefs. At present, this operation is small and caters primarily to hotel guests and non-divers who want to learn snorkeling and scuba. It can handle experienced divers, but only on an individual basis or in small groups up to 12 divers.



# CURAÇAO

The Princess Beach Hotel is located three miles east of town, in the opposite direction from the Hilton. It is also located on the beach and has a gambling casino, swimming pool, restaurant, air-conditioned rooms, tennis courts, cocktail lounge and private beach. The Princess Beach is not quite as luxurious as the Hilton, but then the prices are more economical.

Located on the hotel premises, next to the swimming pool, is Dive Curacao. This is basically a small, two-man business owned and operated by Bert Knubben. Bert caters to hotel guests and tourists who want to learn how to scuba or snorkel. He operates a 17 foot outboard which can carry up to six divers.

Bert is an experienced dive guide with more than 14 years in the business. He

has been a commercial diver and hull cleaner as well as a dive instructor at most of the major hotels. Over the last few years, Bert has devoted much of his spare time to the experimentation and development of a new method for cultivating black coral. He believes black coral can actually be planted and grown at selected underwater sites, and eventually harvested for the black coral jewelry trade.

In addition to the two operators at the beach hotels, there is a full service dive shop in town. The Masterdive Scuba Shop is located at St. Anna's Bay, close to the Amstel brewery. Owned and operated by Frank Englehardt, this shop has PADI full certification courses, scuba equipment sales, air fills, equipment rentals, and regulator repairs. Frank has three large compressors and pumps air for almost all of the divers on Curacao.

Although Masterdive is primarily a retail scuba shop, Frank has just recently



made arrangements for dive charter services aboard a 30 foot cabin cruiser. This craft can take up to 10 divers and can be chartered for either half-day or full day dive trips.

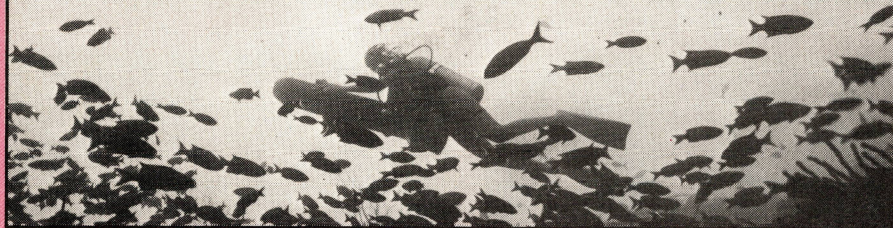
Curacao's reputation as a dive destination has been sorely underrated. In truth, Curacao has some excellent dive locations with extremely healthy coral reefs and a wonderful array of marine life. While the diving may not be as easy or as convenient as it is in Bonaire, it is still worth seeing. In fact, Curacao offers several underwater attractions which cannot be found in the waters of Bonaire.

Perhaps the most popular dive site on Curacao is a shipwreck which lies outside the mouth of Willemstad harbor, just east of the Holiday Beach Hotel. The wreck is a 200 foot long steel hulled Dutch freighter which accidentally sank

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**MASTERDIVE SCUBA SHOP**  
Fokkerweg 13  
Curacao, Netherlands Antilles  
Tel. 54312

### DIVE OPERATORS

**Name** — Dive Curacao  
**Address** — Princess Beach Hotel  
P.O. Box 2050  
Willemstad, Curacao, N.A.  
**Location** — Princess Beach Hotel pool  
**Telephone** — 14944 extension 187 or 53733  
**Owner** — Bert Knubben  
**Compressor** — None  
**Rental Tanks** — 15 steel & aluminum  
**Boats** — 17 ft. Thunderbird/6 divers  
**U.S. Agent** — Hotel Travel Resources Inc.  
501 Madison Avenue  
NY, NY 10022  
(212) 935-9279

**Name** — Masterdive Scuba Shop  
**Address** — Fokkerweg 13  
Willemstad, Curacao, N.A.  
**Location** — In town near Amstel Brewery  
**Telephone** — 54312  
**Owner** — Frank Englehardt  
**Compressors** — Two Mako 15cfm  
One RIX 17.5cfm  
**Rental Tanks** — 20 aluminum  
**Boat** — 30 ft. custom yacht/10 divers  
**U.S. Agent** — Direct

**Name** — Piscadera Watersports  
**Address** — Curacao Hilton International  
Willemstad, Curacao, N.A.  
**Location** — Curacao Hilton pier  
**Telephone** — 25000 extension 177  
**Owners** — Ben and Eva van Dalen  
**Compressor** — None  
**Rental Tanks** — 24 steel & aluminum  
**Boats** — 28 ft. Glassbottom/20 divers  
22 ft. Aquasport/8 divers  
18 ft. Custom/12 divers  
15 ft. Whaler/2 divers  
**U.S. Agent** — Hilton Reservation Service  
415 Seventh Avenue  
NY, NY 10001  
(212) 594-4500



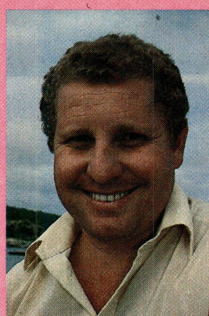
in October, 1977. The ship lies perfectly upright in 100 feet of water, resting on a flat sand bottom at the base of a coral slope. The hull is completely intact, with its stern masts rising straight up to within 40 feet of the surface. The name of this wreck is the **Superior Producer**, and she was carrying a general cargo of clothing, suitcases, wallets, after-shave lotion and other retail goods.

The *Superior* wreck is a stunning sight to behold underwater as the visibility in this area often exceeds 100 feet. On some days divers can view almost the entire length of the ship from a single location. Small corals and sponges have begun growing on the ship's mast, railings and decks. A few pieces of black coral can be seen sprouting on the outside of the hull and there is also a very beautiful hydrocoral growing on the bow railing. This lovely formation has orange branches with pure white polyps. All of the ship's hatches and doors are open and divers can explore the interior of the wheelhouse and cargo holds. Resident fish life on this wreck includes a large green moray which lives inside it and several barracuda who hover above the decks.

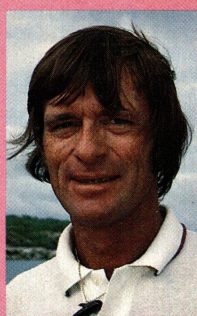
One of the prettiest dive spots still within range of the beach hotels is a place called Vaersenbaai. This small secluded cove lies six miles west of the Hilton Hotel and can be reached by boat in 30 to 40 minutes. The reef begins 60 yards off the beach, starting with a level coral garden in 20 feet of water. The sea floor in this area is literally carpeted with green and purple tipped anemones. I have never seen so many of these creatures concentrated in a single area. At one point I counted over 60 different anemones within sight of my position. The amazing thing is that practically every anemone harbored at least one or two small commensal shrimps or crabs. The same reef was also loaded with a tremendous variety of Christmas tree worms, feather-dusters, and other species of tube-worms. On one coral head alone I counted 30 different Christmas trees growing in the space of one square foot.

From this shallow coral garden, the reef slants downward on a 45 degree angle to a depth of 160 feet. The steep slope is loaded with a rich mixture of marine life, including star coral, seawhips, brain corals and seaplumes. Our dive guide pointed out a beautiful cluster of purple tube sponges at the 40 foot level. At 60 feet we began encountering long strands of wire coral that were almost as thick as spaghetti. From 80 to 100 feet we found many beautiful orange sponges of all shapes and sizes.

Still another unusual dive in Curacao is a spot known as Bus Stop Reef. This spot is actually an artificial reef made up of three ancient buses, 30 old automobiles, and two big barges. The reef components were sunk in 1968 and have had more than 13 years to become encrusted



Frank Engelhardt



Bert Knubben

with marine life and attract fish. This reef is located directly in front of the Princess Beach Hotel, approximately 50 yards offshore.

Dive depths on Bus Stop Reef range from 60 to 160 feet. Many of the cars have become overgrown with corals, sponges and gorgonians.

Further east from the Princess Beach Hotel lies the wreck of a small tug boat, just off Caracas Bay. This little tug is only 35 feet long and is sitting upright on the bottom in 15 feet of water. It has been submerged for more than 20 years and is virtually overgrown with *Tubastreae* cup corals and a variety of marine life. The wreck sits at the edge of a coral slope which runs from 20 to 160 feet. The diving along this reef is absolutely superb and serves as a nice adjunct to the wreck.

While Curacao may not be the diver's



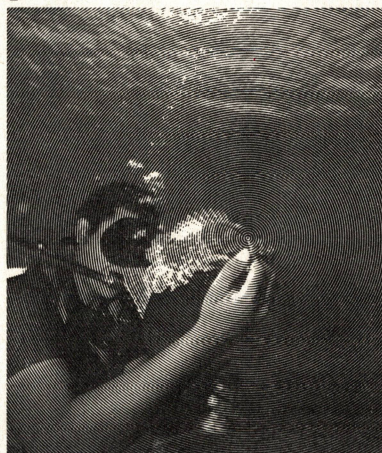
Masterdive dive boat



Dive Curacao, Princess Beach Hotel

primary destination, it is certainly worth consideration as an additional stopover. The cosmopolitan city atmosphere offers a totally different vacation experience and there is most definitely at least two or three days of good diving which can be done fairly conveniently. Considering the long journey required from the U.S. mainland to the ABC islands, a side visit to Curacao is indeed a bargain. 🐟

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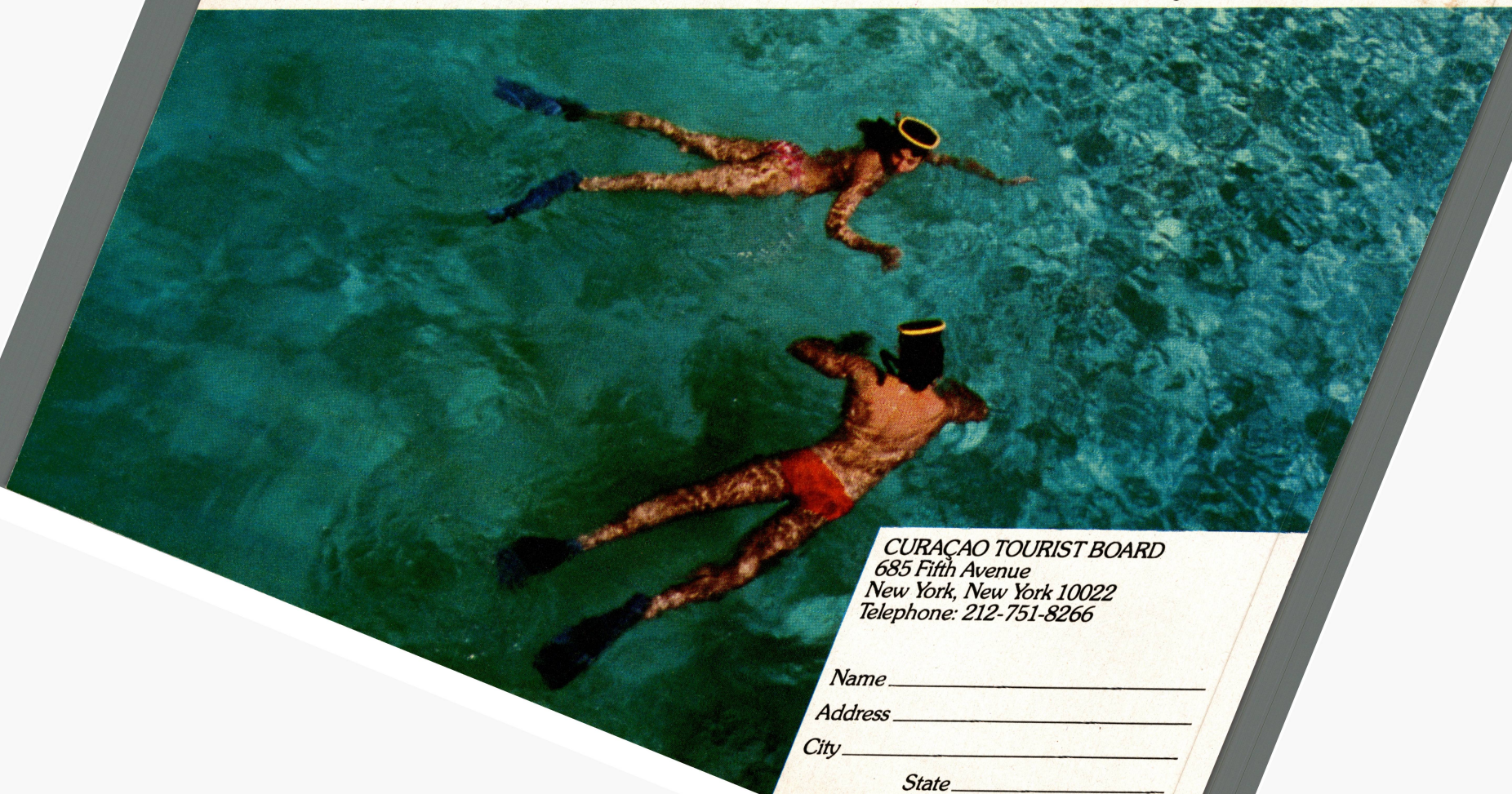
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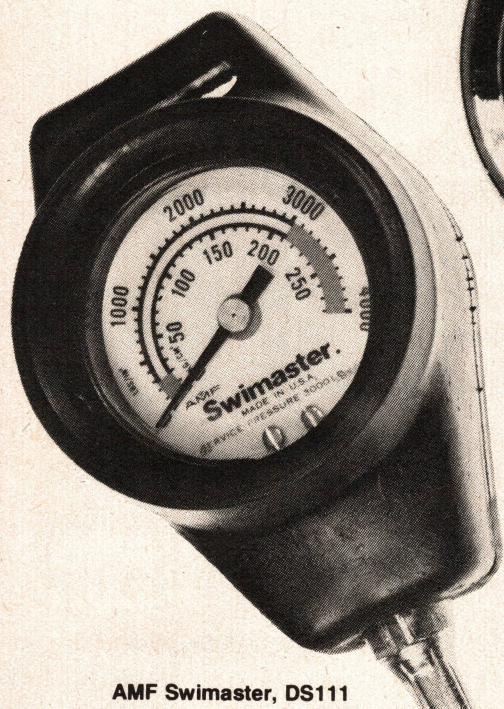
# SUBMERSIBLE PRESSURE GAUGES

Gauge Your Safety - SDM  
Reports on 19 SPG's That  
Tell You the State of Your  
Air Supply Underwater

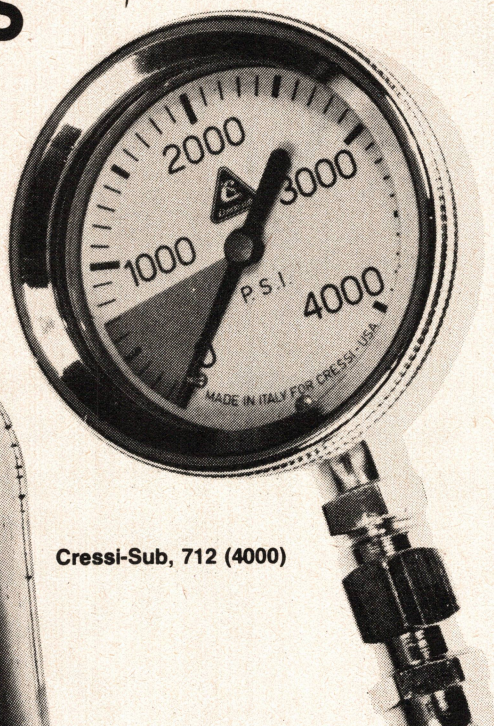
Text and Photography  
by George Cozens



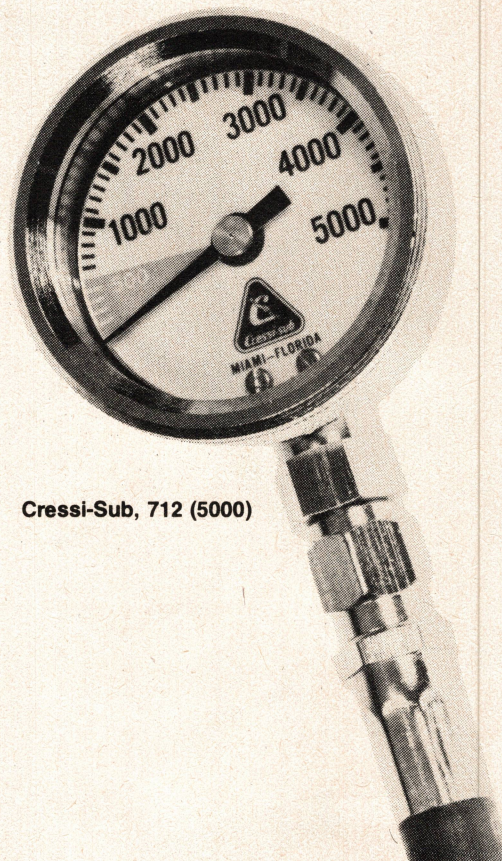
# SUBMERSIBLE PRESSURE GAUGES



AMF Swimaster, DS111



Cressi-Sub, 712 (4000)



Cressi-Sub, 712 (5000)

It was a Volkswagen Bug, of the late 1950's vintage. To many people it was just an ugly, little economy car. To me, however, it was the pride of my life: Inexpensive and (normally) very reliable transportation. It was a great little car — but not perfect. One of its most noticeable faults was that it had no fuel gauge. Apparently, the gas gauge was omitted by Volkswagen for reasons of economy, and as a substitute a reserve valve was provided that, when needed, could be operated by the driver's right foot. When the Bug started to sputter, and the driver suspected a low gas level, the reserve valve could be opened and about one more gallon of gas was supposed to be available — enough, hopefully, to get to a local service station.

As you can probably imagine, there were several problems with this arrangement. For one, unless the gas tank was completely full, or completely empty, the driver could never be certain about the actual gas level. I remember

more than one occasion when I would have to open up the bonnet (that's Volkswagen for hood), unscrew the gas cap, and peer into the dark tank, or use a long wooden dip stick, to check the fuel level. At best, this was not always a safe maneuver. Like many Bug drivers, I found it advisable to keep good records, calculate fuel consumption, then estimate when it would be necessary to fill up. Even with these precautions, however, there were still times when the Bug would suddenly cough and choke, then lose momentum. Of course, turning on the reserve valve was an immediate solution — provided it worked. Unfortunately, it didn't always. In some cases the reserve valve might have malfunctioned — more often than not, the driver simply had forgotten to return the valve to the off position from a previous occasion, or the reserve had become clogged from lack of use. Whatever the cause, as the last bit of available gas was consumed the car would sputter, go into more violent spasms, then, lurch to an uneven stop.

Oh, what nostalgic memories. But what does all this reminiscing have to do with diving? Actually, there's a very

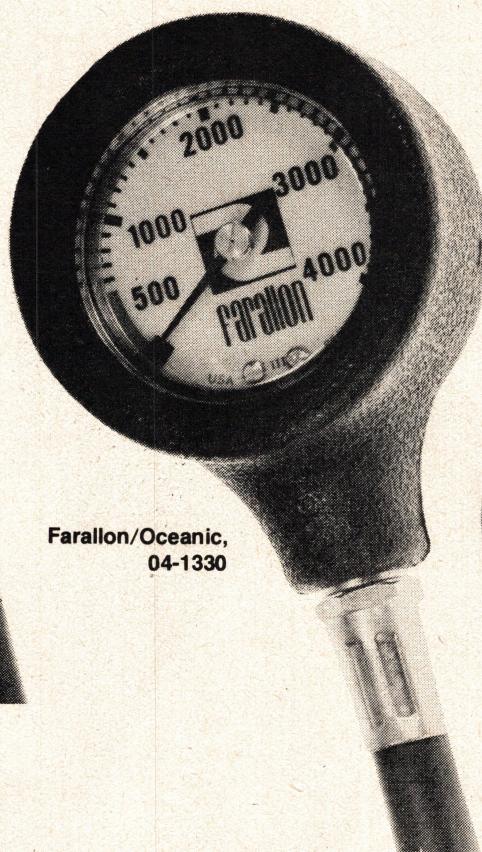
close analogy to scuba. Within less than a decade of the first successful dive made with a high pressure air tank and a two-hose, two-stage, automatic demand regulator (1943, by Jacques-Yves Cousteau and Emile Gagnon), scuba was introduced to the United States. During the early to middle 1950's, while scuba diving was still in its infancy, the sport was practiced mainly by people who were already oriented to the water: military divers, life guards, etc. As a general rule, these early scuba divers were already excellent free divers. If they ran out of air underwater, (in fact, some would intentionally drain their tank empty at depth), they would simply terminate the dive and return to the surface. Divers who wanted additional safety could buy a tank valve which incorporated a reserve mechanism, designed to give the diver warning when the last 200 to 300 psi had been reached. But, similar to the early Volkswagen arrangement, scuba tank reserve valves were not a perfect solution. If the diver had forgotten to return the reserve lever to the off position at the start of the dive or if the lever had been turned on accidentally during the dive, the unfortunate diver would be out of air.

Of course, the reserve could fail to function for various other reasons — generally from lack of proper maintenance and/or use. Out-of-air problems became more serious as scuba diving

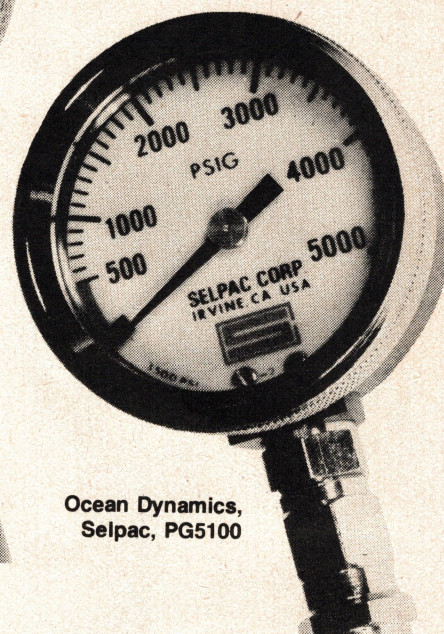




Dacor, TAG



Farallon/Oceanic,  
04-1330



Ocean Dynamics,  
Selpac, PG5100

began to grow and the newer participants began to depend on their reserve valves for a low air warning. When the warning didn't come and these divers found themselves without any air, the next step was usually a hasty retreat to the surface — all too often without much, if any, preplanning. During the mid 1950's, reserve/warning mechanisms appeared on some scuba regulators. With proper care and use, these provided, then (and still do), an important element of safety — they warn the diver of a low air level.

However well these reserve devices performed, the diver still could not determine at any given time during the dive just how much air was left in the tank. Then, in 1959, the first commercially available underwater air pressure gauge appeared for sport diving. It was marketed by Sportways, and was called the Sea-View gauge — a name that is still used today by some long-time divers to refer to submersible pressure gauges in general. At last, scuba divers had available to them a device that could be taken underwater with them to determine the amount of air in their tanks at any moment during the dive.

Since its introduction some 21 years ago, the submersible pressure gauge has undergone a number of changes. The original Sea-View was an end-reading gauge with no swivel (i.e., the hose connected directly to the back of the

gauge), and the diver had to bend the hose back on itself in order to bring the dial into view. The 1981 gauges surveyed in this article are all side-readers (the hose connects to the bottom side of the gauge), with swivel connections between hose and gauge to make reading the dial easier. In general, the newer submersible pressure gauges have larger, easy-to-read dials, with bright, luminescent faces and bold numbers. The pressure gauge mechanisms have become, through the years, more rugged and reliable. Even the names have changed. Sea-View is still in use, but now pertains more specifically to the gauge marketed by Sportways/Waterlung. Submersible pressure gauge, affectionately abbreviated, SPG, refers in general to any air pressure gauge used underwater. Also used are such terms as underwater tank pressure gauge, air monitor, cylinder pressure gauge (CPG), and variations of these. The one important feature that has remained constant throughout all these changes is the ability of the submersible pressure gauge to indicate the pressure, and thus, the amount of air in the scuba tank at any time.

During the last score of years, the attitude of most divers and certifying agencies toward the SPG has gradually changed — from the original concept of an optional accessory piece of gear, to the more current view that it is a primary piece of scuba equipment, mandatory for scuba use. The importance of having and using a submersible pressure gauge is borne out in the evidence collected over a period of years by several local and national dive safety committees from reports of scuba accidents and near-accidents. Their investigations have repeatedly shown that a significant fraction of the cases reported were related to divers running out of air — situations that could have been avoided if the divers involved had submersible pressure gauges and used them.

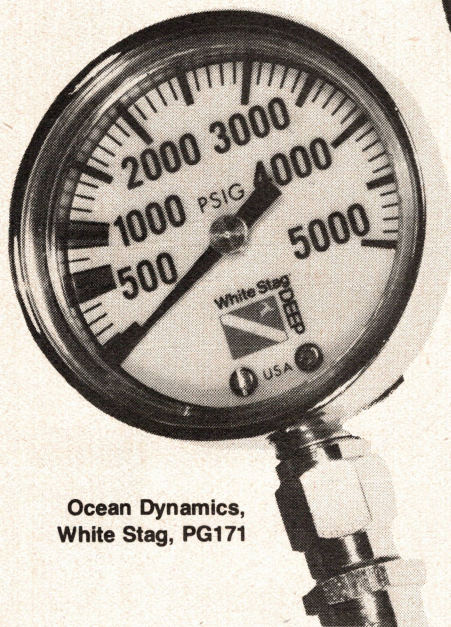
Assuming we agree on the importance of the SPG to dive safety, let's look at submersible pressure gauges in a little more detail.

## DESIGN/CONSTRUCTION

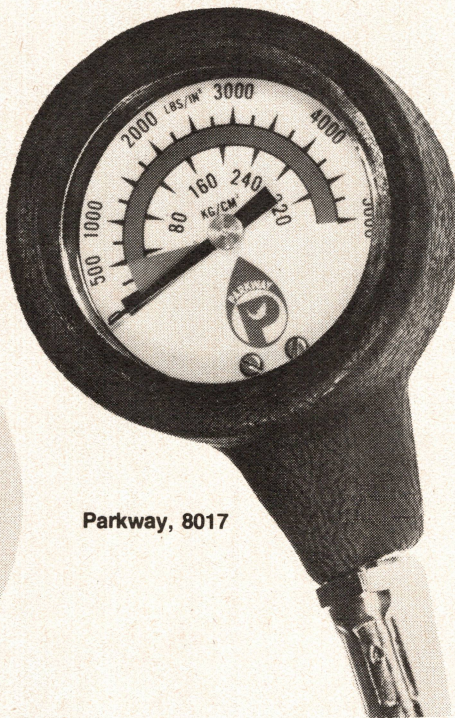
All of the SPG's in this survey operate



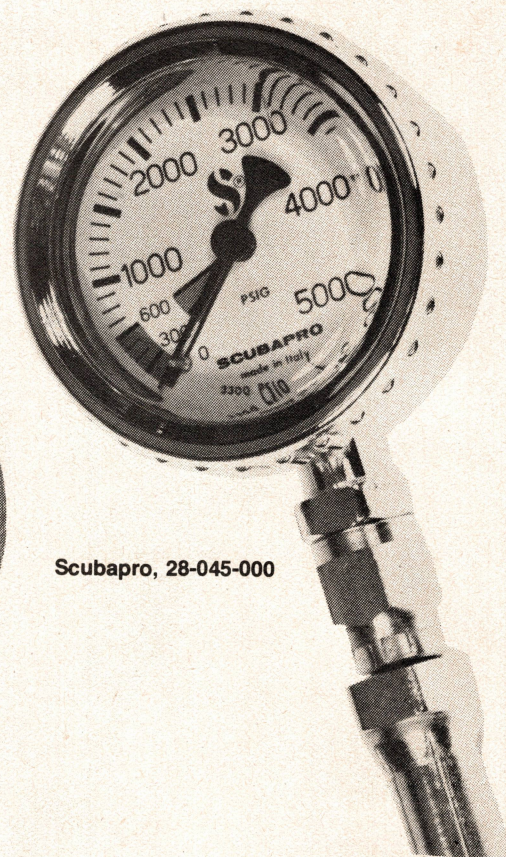
# SUBMERSIBLE PRESSURE GAUGES



Ocean Dynamics,  
White Stag, PG171



Parkway, 8017



Scubapro, 28-045-000

on the principle of the Bourdon tube. This is a curved piece of tubing. One end is sealed and allowed to move, the other end is held fixed and connected to a high pressure air supply. As the air pressure is increased, the Bourdon tube tends to straighten out or uncurl slightly. A very simple analogy is the paper party favors called blowouts — a coiled paper tube that unrolls when you blow into one end. However, Bourdon tubes move only a slight amount, even at maximum pressure. One of three basic designs can be used to translate the movement of the Bourdon tube into a needle reading on the gauge dial:

1. One type of mechanism is called the C-shaped Bourdon tube movement, and is one of the oldest used in SPG construction. The tube is relatively large in diameter, and comparatively short in length. Literally shaped like the letter C, it covers only about two-thirds of a complete circle. Because of its shape the free end of the tube moves only a very slight

distance with changes in pressure. To improve accuracy in measuring pressure, the tube's free end is coupled to the needle shaft by means of a geared lever which amplifies the movement. One criticism of this type of mechanism is that a sharp shock to the gauge may cause the gears to disengage, in effect throwing off the calibration. This may be true, but a close inspection of the C shaped mechanism in the gauge disassembled for this article revealed a very solid construction — any disengaging of gears, in my opinion, would have to be caused by a pretty hard blow.

2. A second type of mechanism is called the spiral wound or spiral wrap Bourdon tube movement. In this newer design the Bourdon tube is quite small in diameter and very long. It spirals in toward the center, making perhaps, 14 or 15 turns, with the free end soldered directly to the needle's shaft. Because this design has fewer moving parts it is reputed to be less sensitive to shock and therefore more reliable. A potential negative criticism might be that because the Bourdon tube in this design moves a greater distance as it flexes and then relaxes, its cycle life would be shorter than other designs. Theoretically this is probably true,

but it is of little practical significance. The spiral wound movement, even with its shorter lifetime, is expected to last upward of 90 years under moderate to heavy use.

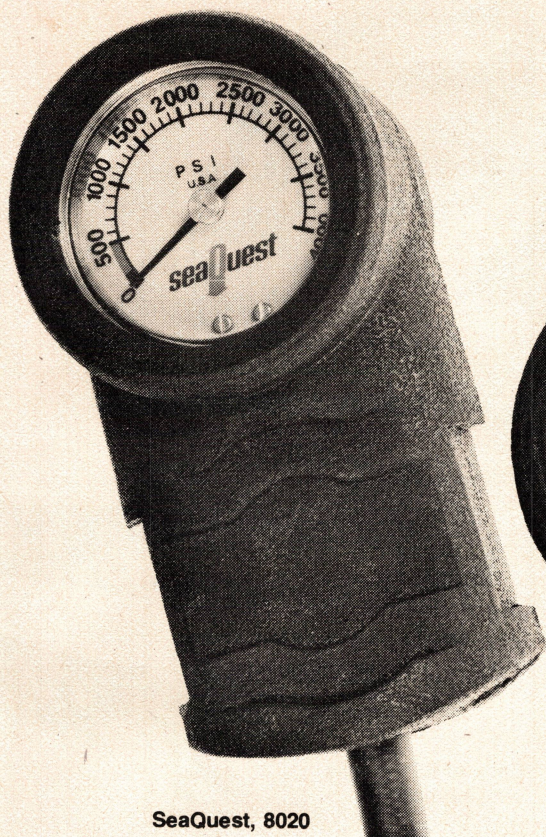
3. The third type of mechanism is a hybrid of the other two and is called the modified C Bourdon tube movement. In this design, the Bourdon tube starts off like a spiral wound mechanism, making one or more turns before the free end is coupled to the needle's shaft via a geared mechanism.

Cases for SPG's can be grouped into two categories: plastic and metal. Plastics range from Lexan to ABS plastic to structural resin. All are impact resistant, lightweight (resulting in, perhaps, a little less hose strain), and immune to salt-water corrosion. Metal cases are chrome plated brass (forged, die-cast and/or machined). They are somewhat heavier, a little more vulnerable to corrosion, but more rugged. Rubber covers offer additional protection. They may not be needed if the gauge is to be installed in an instrument console, but are a worthwhile addition if the gauge (plastic or metal) is to dangle alone.

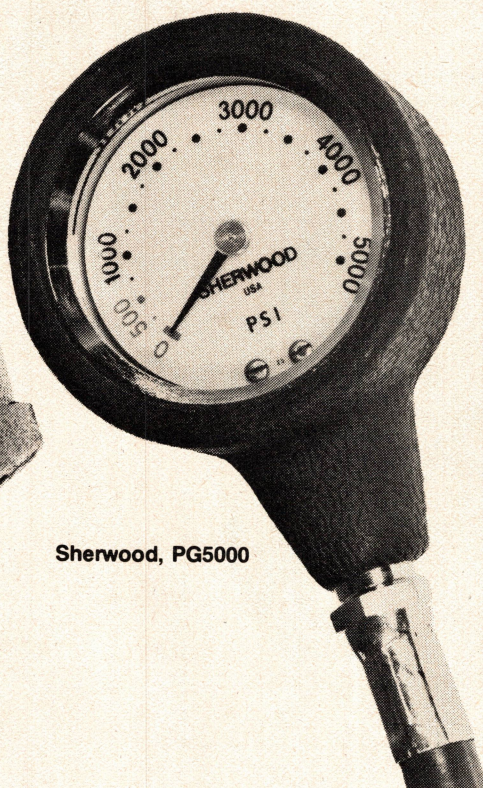
## DIAL FEATURES

One of the more important items to consider in comparing submersible pressure gauges is the dial face. It should display the necessary information but be easy and quick to read. If the gauge looks complicated out of the wa-

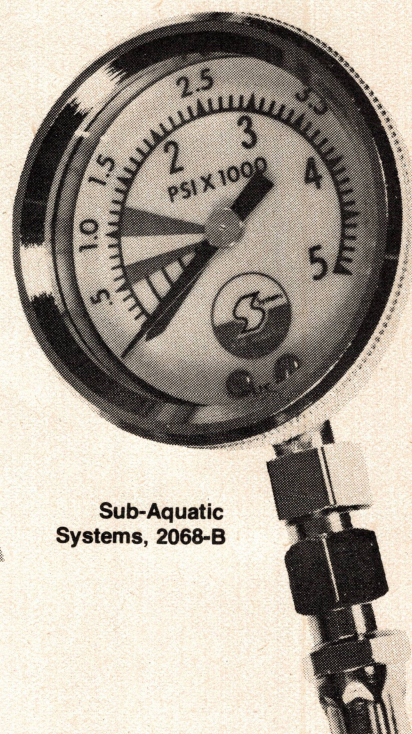




SeaQuest, 8020



Sherwood, PG5000



Sub-Aquatic  
Systems, 2068-B

ter, imagine how much more difficult it might be to interpret at depth. In all the SPG's surveyed, the dials have yellowish, luminescent backgrounds, with highly contrasting markings (in black or dark blue) — making the dial faces very visible, even in dim lighting. For the sake of comparison, examine the dials' scales — how the increments of pressure are marked around the arc through which the needle sweeps. In particular, how readable are the graduations and the pressure values that are labeled?

If you are in the market for an SPG, and are confused about which pressure units to select, I would suggest that you not worry about the pros and cons of the different units. Instead, pick a gauge that is easy to read, and has units of pressure that you understand.

Most of the SPG's surveyed display a low pressure warning zone at the bottom end of the scale. These zones are designated by a sector of the dial which has a solid color (red, blue or black), or has been cross-hatched, and varies (for the different gauges) from the last 700 psi to the last 300 psi. Going a step further, a couple of SPG's have color coordinated zones — brightly colored sectors on the tank pressure gauge that correspond to similarly colored zones on depth gauges of the same brand. By visually trying to keep the SPG and depth gauge needles in the same colored zones, the diver is reminded to ascend to shallower depths as the tank pressure drops — thus promot-

ing earlier ascents from greater depths. While you're comparing pressure gauge dials, notice that the warning zones on some SPG's are graduated while others are not.

#### PRESSURE

One of the more important characteristics of a submersible pressure gauge is its service pressure. Traditionally, service pressure refers to the maximum, normal operating pressure, and for the SPG's appearing in this article, ranges from 3000 psi to 5000 psi. Under normal working conditions, the service pressure should not be exceeded. There are exceptions, however: most pressure gauges will accept being over pressurized by ten percent or so, and should suffer no damage or loss of calibration — this should be enough to cover the situation where a scuba tank is cold filled to 3000 psi and then allowed to heat up in the sun, causing its pressure to increase — remember the gas laws from your basic scuba class? A representative of Sierra Precision, a company in Cucamonga, CA which makes spiral wound submersible pressure gauges for many of the scuba equipment distributors, indicated that spiral wound SPG's can ac-

tually be taken to their full dial reading (4000 to 5000 psi, depending on the brand) without danger or loss of calibration. Repeated over pressurization, however, is not suggested with spiral wound or other types of Bourdon tube mechanisms, if for no other reason than from metal fatigue. Excessive over pressurization can cause any Bourdon tube mechanism (C shaped, modified C or spiral wound), to stretch and permanently change shape — thus destroying the gauge's calibration, and its ability to measure air pressure accurately.

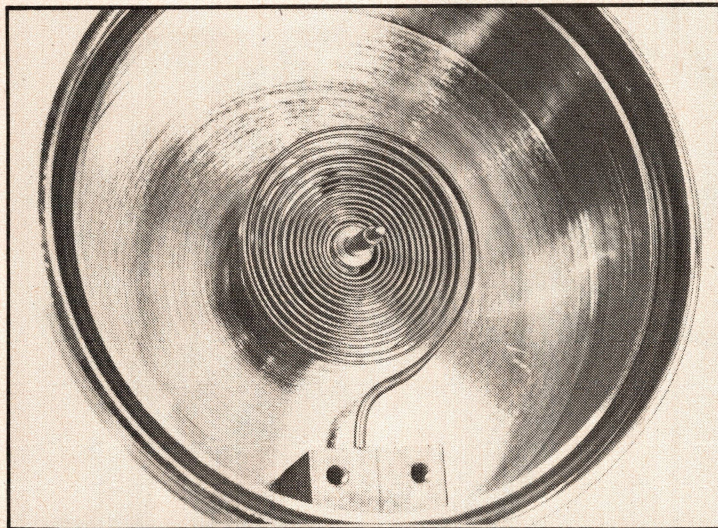
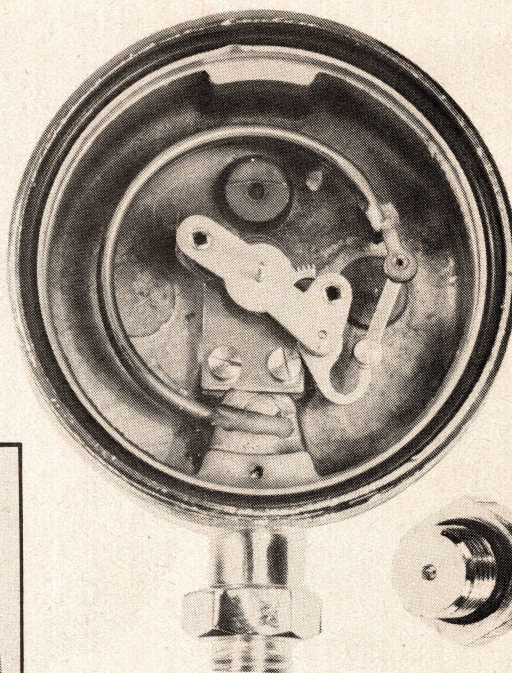
#### ACCURACY

Obviously, every diver would like a submersible pressure gauge that reads accurately, so this is certainly a characteristic worth considering. In my view, the accuracy of a gauge depends on three basic factors: The inherent precision of the device; the diver's ability to read the gauge precisely; and the gauge's ability to maintain its inherent



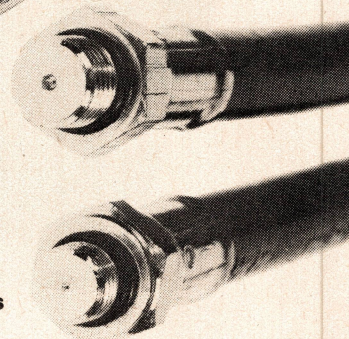
# SUBMERSIBLE PRESSURE GAUGES

A C shaped Bourdon tube  
and the attached gear mechanism.



Internal view of an SPG showing  
a spiral wound Bourdon tube.

Ends of SPG hoses  
with HP orifices.



precision which depends almost entirely on its care and maintenance.

The inherent precision of an SPG is the accuracy designed and built into it. This can be related to a number of variables including design, materials, quality control during construction, and the degree of accuracy specified by the scuba equipment manufacturer/distributor. Rather than look at these in any detail, it would be of more practical value to compare SPG's under laboratory conditions. Fortunately for us, the job has already been done.

In January, 1979, under the direction of James R. Middleton, the Navy Experimental Diving Unit in Panama City, Florida, conducted tests on 14 commercially available submersible pressure gauges. The results of these tests appeared in NEDU Report No. 3-79 entitled, Evaluation of Commercially Available Submersible Pressure Gauges, (March 1979). (A copy of this report should be available for a slight fee from National Technical Information Service, 5285 Port Royal Road,

Springfield, VA 22151 — it may take a while, have patience.) Although the tests were conducted over two years ago (and even then, not all brands/models of SPG's sold in the U.S. at that time were tested), the results are still informative, and a pretty good example of the gauges available today. The results? Well, at the high pressure end of the test, 3500 psig, (g stands for gauge and means "above atmospheric pressure") all of the SPG's tested read within 200 psi of the precision, laboratory standard gauge (not too shabby, since this end is not critical to us as sport divers). At the low end (500 to 200 psig), all of the gauges except one read within 50 psi, and this one gauge was 100 psi off. It is interesting to note that at the 100 psig value, half of all the gauges tested (that's 7 out of 14) read from 25 to 100 psi off the laboratory standard. Before getting too excited about these inaccuracies, let's put them in their proper perspective. None of the gauges tested was bad enough to be rejected. On the contrary, overall, the gauges were quite good, and all were approved for use by the U.S. Navy.

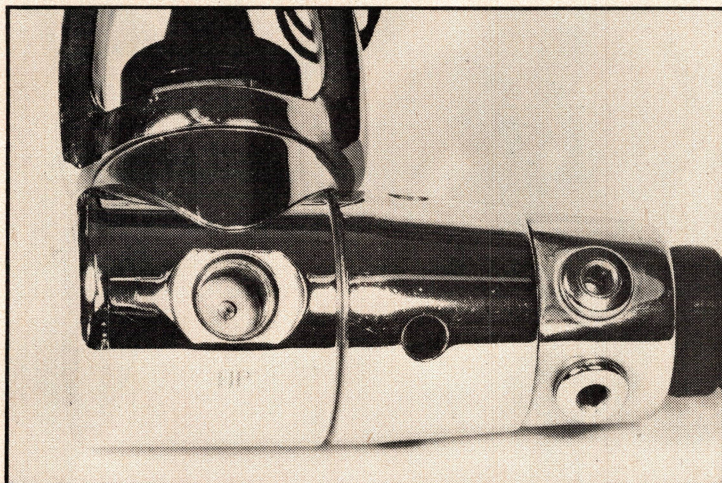
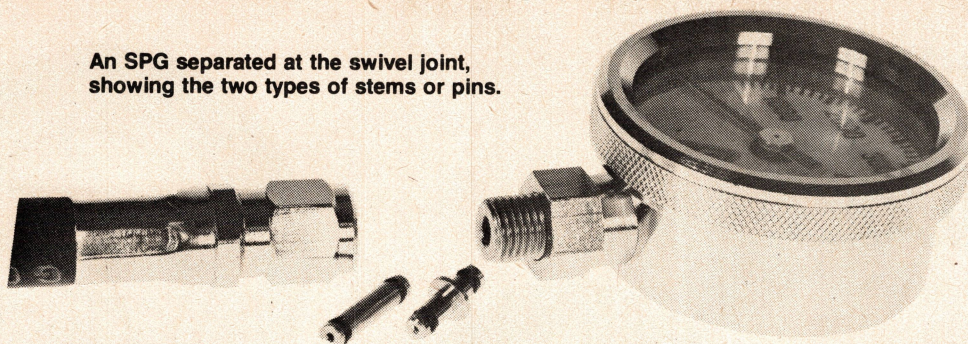
In analyzing the test data, there appears to be no patterns or other clues which might indicate that one brand, one

model, or even one type of Bourdon tube movement is any more or less accurate than another. Indeed, as if to confuse matters, essentially identical SPG's (made by the same manufacturer, but sold under different brand names) ranked at the top, in the middle, and at the bottom of the list, in terms of accuracy. Probably the most important lesson to learn from this information is that the submersible pressure gauge is a reasonably accurate instrument designed to withstand heavy wear and tear, and a minimal amount of abuse — it is not, however, a precision, laboratory standard gauge (we couldn't afford one anyway), and should not be expected to perform as such. (If you are concerned about the inaccuracies, consider the following remarks taken from the conclusion of Middleton's report: "... a certain tolerance in [SPG] accuracy is to be expected. A careful diver must be cognizant of the accuracy limitation inherent to the submersible pressure gauge and use it accordingly... Thus a diver must not expect these gauges to provide reading accuracy better than  $\pm 250$  psig at the upper end of the gauge range and  $\pm 100$  psig at the lower end between 500 and 0 psig. Nevertheless, a submersible pressure gauge serves as a valuable diving instrument and should be considered *indispensable* for mission [dive] planning and diver safety." (Emphasis added by the author.)

Accuracy also depends to some de-



An SPG separated at the swivel joint, showing the two types of stems or pins.



First stage of a regulator showing the tiny high pressure orifice.



The first Sea-Vue gauges were end-readers like the one pictured above.

gree on the diver's ability to interpret the gauge reading. Obviously, this will differ from diver to diver — especially when the gauge's pressure scale has a gap in which no graduations are shown. For example, trying to estimate the position of the needle when it is somewhere in the low pressure zone, with no graduations between 0 and 500 psi, would be largely a matter of opinion. Does it really matter? When the pressure indication is at or near the 400-500 psi mark, the dive should be over and the diver on the way up. The real accuracy at 100 psi, then, is only academic. Divers who find themselves suddenly out of air while trying to read the gauge at 50 or 100 psi can only blame themselves for their predicament.

#### ACCESSORIES

At first, it seemed silly to think of a simple device such as an SPG as having accessories. But it does, and they are well worth mentioning. We've already discussed the benefits of a rubber cover, and the protection from shock it provides. Most divers just let their pressure gauge dangle at the end of its hose. This arrangement allows the gauge to bang into rocks and coral, get caught in crevices or kelp and puts strain on the hose near the connections. In this regard, consider using a retaining strap. This can keep the SPG up and out of the way — ready to read, with less chance for it to get caught on, or bounce into U/W objects — but the strap should not interfere

with dropping the weightbelt and/or the tank in an emergency. Hose protectors, when placed at the upper and lower ends of the SPG hose, can also help relieve the strain on the hose where it is most susceptible to breakdown and failure — near the metal connectors. Still another accessory is a capillary depth gauge that fits around the lens ring of some submersible pressure gauges. This is certainly a convenient location — the depth gauge is readily available, allowing the diver to monitor both depth and air pressure and perhaps eliminates one more instrument from the diver's arm or wrist. If the idea appeals to you, be certain of one thing: that the capillary gauge does not obstruct your view of, nor create confusion in, reading the SPG.

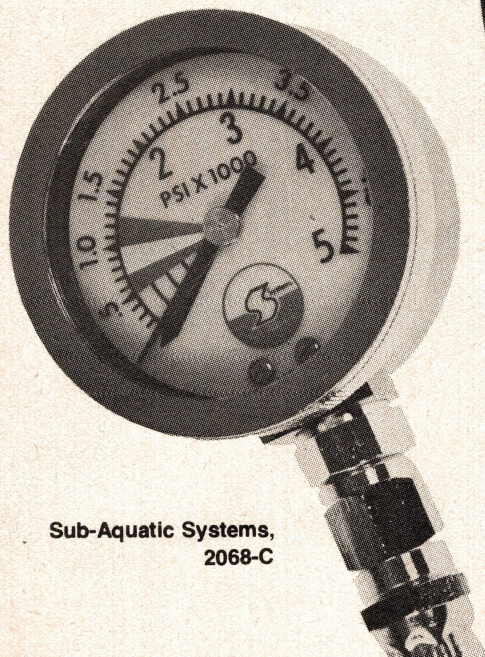
#### SAFETY

The submersible pressure gauges in this article all appear to be well made and rugged. They have an excellent safety record in this country — but that doesn't mean accidents can't happen. Probably the greatest potential for accidents occurs when divers are adding or changing accessories on the first stage of the regulator. Care must be exercised to ensure that the SPG connects to the high pres-

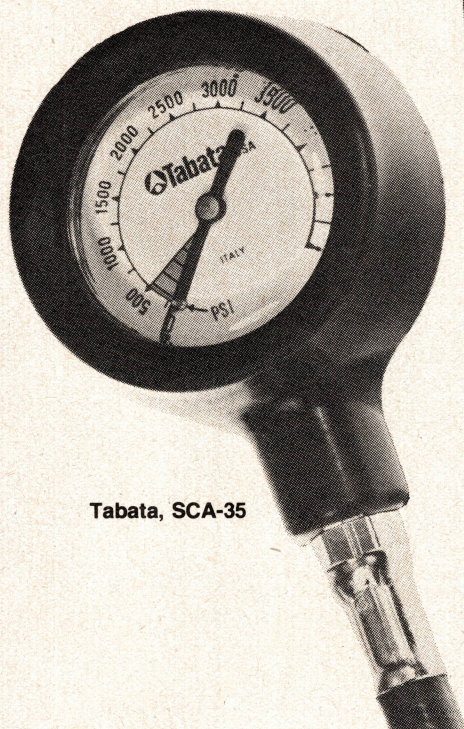
sure (HP) port of the first stage, and that all low pressure accessories connect to the low pressure (LP) port(s). Some regulators have different size HP and LP ports, so the two cannot be confused. Notice in the table that some SPG hoses have the larger 7/16 inch connector to match the larger HP ports. This is a good concept, but unfortunately not many manufacturers have adopted the idea — and it can be easily circumvented by the use of an adapter. When replacing SPG hoses, only suitable high pressure hoses and connectors should be used, and for good reason. First, the hose and fittings are designed and tested for high pressure use (usually around 4000 psi — the actual burst pressure may be as high as 12000 to 15000 psi). Second, the connectors have very small openings which are only about 0.010 to 0.015 of an inch in diameter — just like the small opening inside the regulator's HP port — so that if a leak develops, the rate at which air is lost will be restricted. U.S. Divers indicates that because these openings are so



# SUBMERSIBLE PRESSURE GAUGES



**Sub-Aquatic Systems,  
2068-C**



**Tabata, SCA-35**



**Tekna, T-2500**

small, a standard 72 scuba tank filled to 2000 psi would take about 40 minutes to empty, should a large leak develop in the hose or SPG. Under typical sport diving conditions this should allow ample time to return to the surface. If a high pressure leak occurs in your SPG or its hose, your world won't automatically come to an end — it will just sound that way. Also, because these openings are so small, it takes the air pressure longer to reach equilibrium between the first stage and the SPG. When you inhale from your second stage, the pressure in the regulator drops slightly, then recovers to its initial value. The SPG tends to follow this slight drop in pressure (with each inhalation), but is a little delayed because of the small openings. This is the reason for observing the SPG needle drop soon after

taking a breath on scuba. If you want to check your tank pressure accurately, wait until the needle comes to rest at its higher position.

The inside of the SPG case is essentially an almost empty chamber containing only the Bourdon tube movement, needle and dial. It is kept at approximately atmospheric pressure with an O-ring seal under the lens and a one-way pressure relief valve in the back of the case. The purpose of the relief valve is to vent off the air in case a high pressure leak should occur in the Bourdon tube, but prevent water from entering under normal conditions. If this relief valve (which may be a small rubber mushroom valve, or simply a tight fitting rubber plug) should fail to seal, water can enter the case and corrode the interior — in time causing a leak in the Bourdon tube. The rubber-plug type relief valves may become dislodged while being transported in an airplane — so it is a good idea to inspect this type prior to entering the water again. By all means, pressure relief valves should not be prevented from

doing their intended function: do not glue the plugs into place; and be careful of putting any SPG into a rubber cover or instrument console which blocks the valve's opening.

Even with all these precautions it is a good practice to hold the hose and SPG away from your face when turning on the air. It doesn't cost anything and may prevent an accident.

## MAINTENANCE

The submersible pressure gauge should not require much more care than you would give a fine regulator. Because the SPG is a reasonably precise instrument, you should protect it from shock. While diving protect it from banging into and getting caught on rocks, reefs, coral, etc. When packing, try to pad the regulator and SPG with your wetsuit, a large towel, or something similar. And, avoid placing heavy objects on top of the gauge. At all times, try to avoid kinking the hoses, as this will break them down. Inspect the SPG hose frequently for chafing, tears, blisters or bubbles and replace as needed. After diving, dry off the high pressure valve seat on the regulator's first stage, dry off the dust cap and secure it. Water entering the first stage cannot only cause damage to the regulator, but it can migrate down the hose to



# SUBMERSIBLE PRESSURE GAUGE MANUFACTURERS

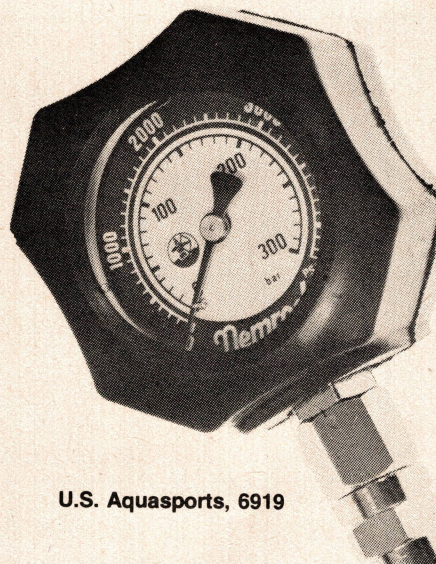
MANUFACTURER/ MODEL	GAUGE UNITS	SERVICE PRESSURE	MAXIMUM READING	BOURDON TUBE TYPE	CASE MATERIAL	HOSE LENGTH	HOSE CONNECTOR THREAD DIAMETER	RUBBER COVER	RETAIL PRICE
AMF SWIMASTER DS 111	psi and Kg/cm <sup>2</sup>	3000 psi/ 210 Kg/cm <sup>2</sup>	4000 psi/ 280 Kg/cm <sup>2</sup>	Spiral wound	Plastic	30"	3/8"	Std.	\$60.00
CRESSI-SUB 712 (4000)	psi	3500 psi	4000 psi	C shape	Chrome plated brass	30 1/4"	3/8"	Opt.	\$64.00
712 (5000)	psi	3500 psi	5000 psi	Spiral wound	Chrome plated brass	30"	3/8"	Opt.	\$64.00
DACOR TAG	psi and kPa*	3500 psi/ 24000 kPa	4000 psi/ 28000 kPa	Modified C	Lexan plastic	32 1/2"	3/8"	Std.	\$65.00
TAG-M	kPa and bars	24000 kPa/ 240 bars	28000 kPa 280 bars	Modified C	Lexan plastic	32 1/2"	3/8"	Std.	\$65.00
FARALLON/OCEANIC 04-1330	psi	4000 psi	4000 psi	Spiral wound	Lexan plastic	30 3/4"	3/8"	Std.	\$70.00
OCEAN DYNAMICS INT. (Selpac & White Stag)									
Selpac PG 5100	psi	3500 psi	5000 psi	Spiral wound	ABS plastic	30"	3/8"	Opt.	\$50.00
White Stag PG 171	psi	3500 psi	5000 psi	Spiral wound	Chrome plated brass	30"	3/8"	Opt.	\$70.00
PARKWAY 8017	psi and Kg/cm <sup>2</sup>	3500 psi/ 240 Kg/cm <sup>2</sup>	5000 psi/ 320 Kg/cm <sup>2</sup>	Spiral wound	Plastic	29"	3/8"	Std.	\$59.90
SCUBAPRO 28-045-000	psi	3300 psi	5000 psi	C shape	Chrome plated brass	34"	7/16"	Opt.	\$80.00
SEAQUEST 8020	psi	3000 psi	4000 psi	Spiral wound	Lexan plastic	33 1/2"	3/8"	Std.	\$77.25
8024	Kg/cm <sup>2</sup>	210 Kg/cm <sup>2</sup>	280 Kg/cm <sup>2</sup>	Spiral wound	Lexan plastic	33 1/2"	3/8"	Std.	\$77.25
SHERWOOD PG 5000	psi	5000 psi	5000 psi	Spiral wound	Chrome plated brass	30"	3/8"	Std.	\$65.00
SUB-AQUATIC SYSTEMS 2068-B	psi or Kg/cm <sup>2</sup>	5000 psi or	5000 psi or	Spiral wound	Chrome plated brass	33"	3/8"	Opt.	\$90.00
2068-C	psi or Kg/cm <sup>2</sup>	320 Kg/cm <sup>2</sup>	320 Kg/cm <sup>2</sup>	Spiral wound	ABS plastic	33"	3/8"	Opt.	\$80.00
TABATA SCA-35	psi	5000 psi	5000 psi	C shape	Chrome plated brass	29 3/4"	3/8"	Std.	\$72.00
TEKNA T-2500	psi	3200 psi	4000 psi	C shape	Structural resin	32 1/4"	3/8"	Std.	\$69.95
T-2501	Kg/cm <sup>2</sup>	230 Kg/cm <sup>2</sup>	280 Kg/cm <sup>2</sup>	C shape	Structural resin	32 1/4"	3/8"	Std.	\$69.95
U.S. AQUASPORTS 6919	psi and bars	4200 psi/ 300 bars	4200 psi/ 300 bars	C shape	Chrome plated brass	28 1/4"	3/8"	Std.	\$90.00
U.S. DIVERS 7036	psi	3000 psi	4000 psi	Spiral wound	ABS plastic	33"	3/8"	Std.	\$70.00
7038*	psi	3000 psi	4000 psi	Spiral wound	ABS plastic	33"	3/8"	Std.	\$93.00
WATERLUNG 1408	psi	3500 psi	5000 psi	Spiral wound	Chrome plated brass	30 3/4"	3/8"	Std.	\$87.00
1408	bars	240 bars	350 bars	Spiral wound	Chrome plated brass	30 3/4"	3/8"	Std.	\$87.00

\* Bars and kilopascals (kPa) are international units of pressure

\*\* 7038 is a 7036 with a capillary depth gauge around the lens



# SUBMERSIBLE PRESSURE GAUGES



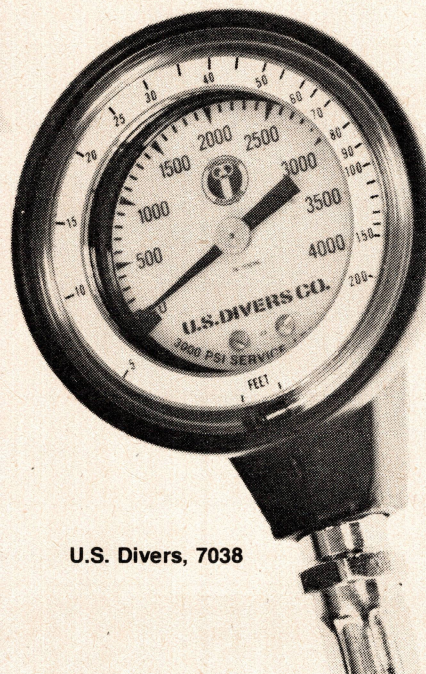
U.S. Aquasports, 6919



U.S. Divers, 7036



Waterlung, 1408



U.S. Divers, 7038

the SPG, where it can corrode the thin walls of the Bourdon tube, eventually causing a high pressure leak.

A common scene among divers is a leaking swivel connection. Fortunately, this problem is quite easy to fix. If the leak is small, the easiest solution is to continue the dive (being careful to monitor the SPG closely: The leak may look bad, but generally not much air is lost), then have a dive shop or scuba repair facility fix the swivel connector later. If you have two wrenches (adjustable ones work well) and even a minimal mechanical ability, you can make the repair yourself. Using the wrenches, simply unscrew the two hexagonal nuts closest to the SPG (one is attached to the SPG case, the other to the hose — both should be locked together until you loosen them), pull the SPG off the hose, and extract the small metal stem. These are usually brass, but Cressi-Sub has one in stainless on its 4000 psi gauge. This stem may be a straight pin, or a pin with a collar at its center — both have a small O-ring at each end. You can replace just the O-rings, or replace the stem and the O-rings (since the stem can wear and eventually break). Prior to assembly, lubricate the O-rings lightly with Dow O-ring lube, or even silicone grease (OK here, since the SPG is not in the path of your breathing air). Check and clean the

mating O-ring surface, then reassemble, tightening the two nuts snugly. This problem is so common, yet so simple to fix, that it would be a good idea to carry a couple of wrenches and an extra stem (with O-rings) or two in a spare parts kit. But, find out which type of stem fits your SPG first.


If you suspect that your SPG is grossly in error, has water inside or for some other reason requires professional service, take it to a dive shop or scuba repair facility and have it examined, repaired and/or calibrated. It's not worth the risk to

dive with a faulty pressure gauge — too much depends on its proper operation.

It is always a good idea to read any instructions the manufacturers may distribute with their products. Some manufacturers suggest using silicone spray to improve the looks and increase the longevity of the rubber parts; others caution against using silicone spray, especially if the spray contains chlorinated solvents, as these solvents may attack the plastic parts of the gauge. Better to read the instructions — and the contents of cleaners or lubricants first — in order to avoid potential problems later.

## USE

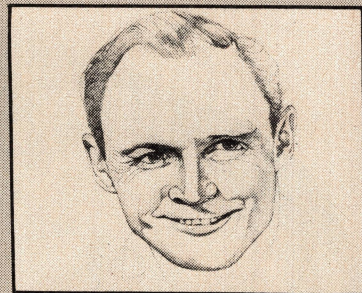
One of the simplest things to do with your SPG is to use it properly. This requires nothing more than reading the pressure frequently during the dive and starting the ascent when the air pressure gets low. The submersible pressure gauge is a passive device — it doesn't sound an alarm, activate a vibrator, or pinch the diver when the tank pressure gets low. *To be of use, the SPG must be read by the diver.*

Considering the submersible pressure gauge's contribution to dive safety, its ease of use and maintenance; its accuracy and reliability; and its reasonable cost, there is just no rational reason why a scuba diver should dive without one. 



# Technifacts

BY E.R. CROSS



In September, 1980 SKIN DIVER Magazine's Technifacts discussed methods of searching for and recovering objects lost beneath the surface of the water. Since then Technifacts has received several questions and comments on recovery techniques. The general trend of correspondence was that additional data on lifting devices was needed.

Almost anything that floats can be used by an ingenious diver to raise an object from the bottom. To be useful for a commercial scuba diver, where results and not effort are being paid for, the flotation device must be reasonably compact and easy to handle. The devices that are the most compact, easiest to handle, and easiest to attach are commercial lift bags. They come in many sizes ranging from about 100 pounds lift to many tons in lifting capacity. There are problems with these units also. Probably the biggest drawback is that they are readily punctured by coral or barnacle encrusted objects or by jagged metal. Also, they are not available in most localities and they cost a lot of money when compared to other make-do systems.

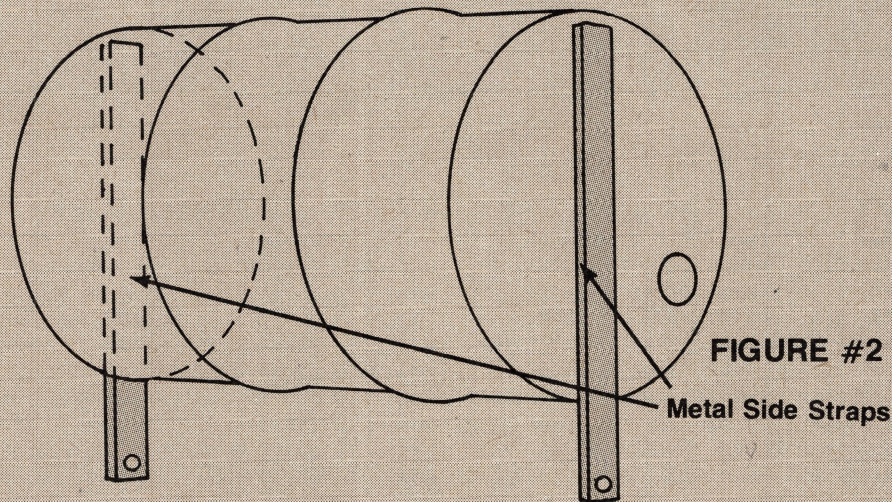
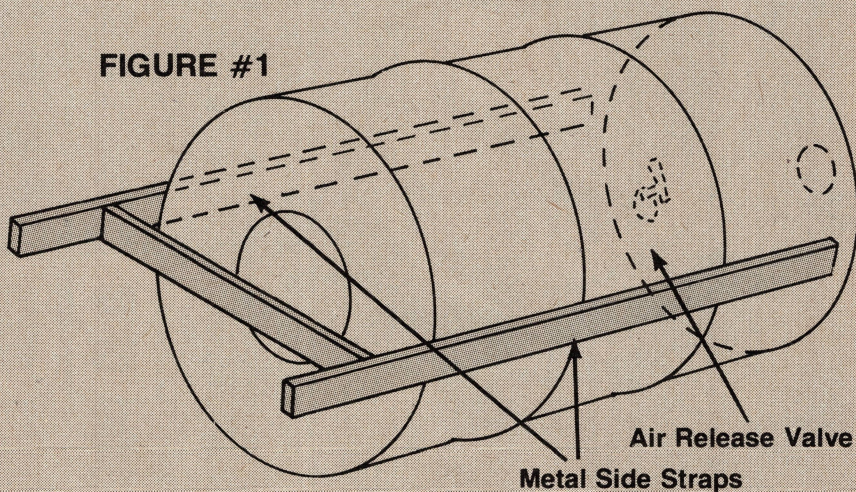
Thus, commercial divers are constantly called upon to improvise when raising sunken objects. Fifty-five gallon drums and inner tubes of various sizes are often used.

In September, Technifacts discussed methods of lifting and floating objects using 55 gallon drums and referred to sketches. Owing to space limitations, the sketches could not be included. These, with additional information on lifting devices used by SDM readers, are presented in this month's Technifacts.

Some objections to 55 gallon drums, and similar drums of different sizes, are that they take up a lot of space and are difficult to handle and to sink below the surface. They do take up space, and compared to collapsible lift bags, are difficult to handle. But they are cheap, readily available in almost all areas, and are versatile since they can be used as is or in various degrees of adaptation.

To make the most versatile flotation device from a 55 gallon drum, follow the instructions in the September SDM and as outlined in Figure #1. The most im-

FIGURE #1



portant design feature shown is the use of a valve in the smaller of the two fittings in the top of the drum. A short pipe nipple and a valve is installed on this and is used to control buoyancy or to let the air out of the drum when the lift is completed.

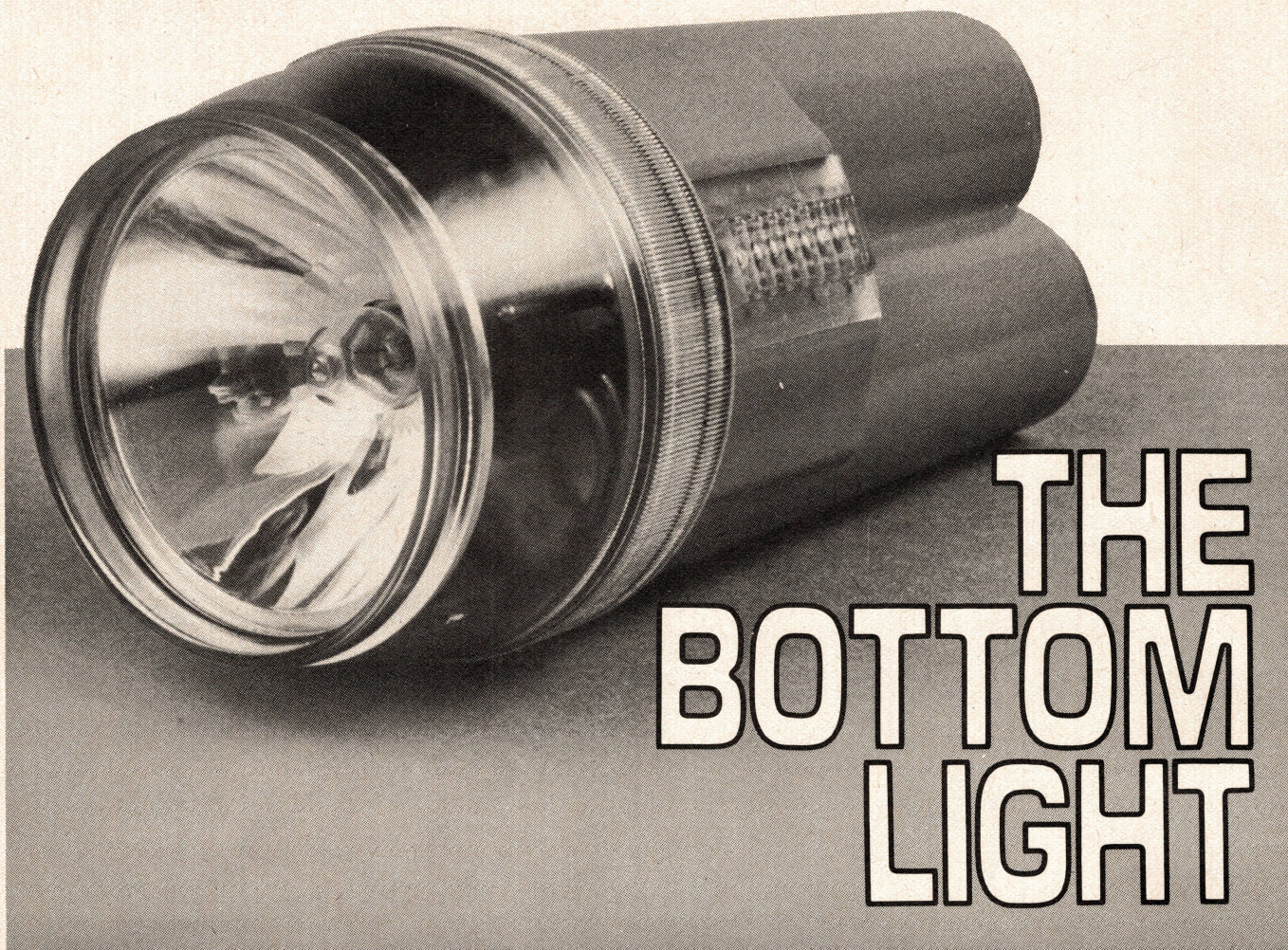
An eight inch (approximately) diameter hole cut into the bottom of the drum, rather than cutting out the entire bottom, permits rapid venting of excess air but retains most of the air in the drum once the lift is on the surface. Also, this opening permits rapid flooding. Another important feature is the side straps of one-quarter by four inch metal welded to the sides of the drum. The holes burned

in the bottom of the straps are used to attach the lifting chains to the object to be raised. The installation of the straps and the use of chains, rather than rope, make for a very secure lifting and holding system. To sink the drums directly to the job, attach a stout line to the object to be raised and slide the sinking drums down this line as they flood.

Figure #2 is a drum adapted for use as a float once an object has been raised to the surface. In this unit the drum is left intact with both plugs in place. Two metal straps are welded across the ends of the drum and holes are burned into the lower ends of these straps for taking the

(Continued on Page 64)





Over the last year or so, the popularity of mini dive lights has virtually skyrocketed. These inexpensive items provide night divers and cave divers with low cost back-up lights for safety purposes. They are compact, which makes them convenient for divers to carry in BC pockets or special holsters. Strapped to a strobe, they are ideal for either night photography or interior photography on wreck and cave dives. And, such lights are very handy for poking around in small crevices, ledges, potholes or caves.

The latest manufacturer to join the mini light competition is Princeton Technics. The company that brought you the Bottom Timer, now has an equally attractive device known as the Bottom Light. It has a distinctly different design incorporating several clever features.

#### BASIC DESIGN

The Bottom Light is an extremely attractive light with modern contours. It is only six and one-half inches long and two and one-half inches in diameter. The outer case consists of two basic parts:

the battery case and the front nose cone.

The battery case is constructed of a high-impact Lexan, molded to fit snugly around four alkaline C cells. Its shape vaguely resembles a double-barreled shotgun. Because of this twin cylinder design, the light will not roll across the deck of a rocking dive boat. There is a small eyelet at the rear of the case for attaching a wrist lanyard or other type of safety line. Built into the top of the case is a sliding on/off switch, also made of Lexan. Because the switch is magnetically activated, there is no through-hole fitting. The front portion of the battery case contains molded threads and a bore-type O-ring for watertight sealing. Each case is pressure tested to 300 feet.

The transparent front cover of the Bottom Light is also made of molded Lexan. The owner can see the reflector and bulb as well as the area behind the reflector; the magnetic switch, electrical connections and front portion of the batteries. This feature is unique among mini lights and allows a diver to tell if the light is leaking water or flooded. Another distinctive feature of the clear front nose cone is that

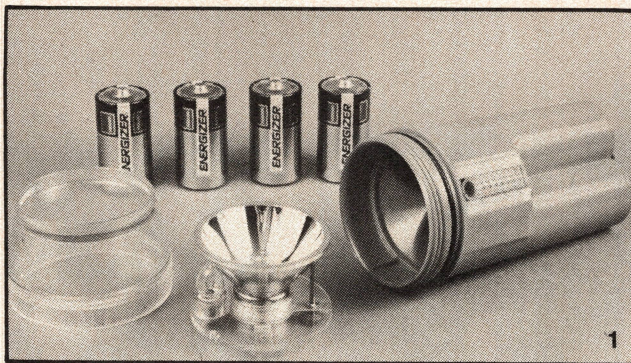
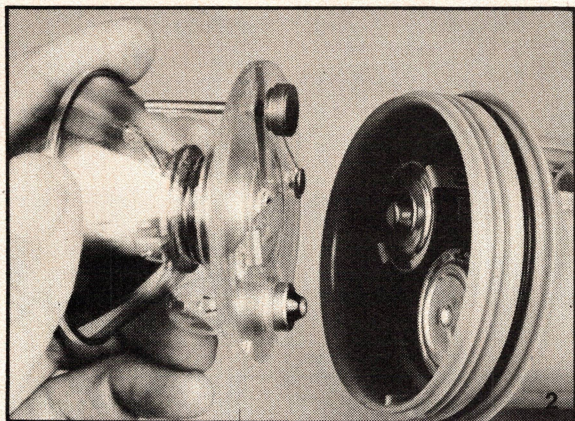
it enables the diver to check the O-ring for a perfect seal. If the O-ring is properly seated, the diver should be able to see a thin black line around the bottom edge of the cover.

The Bottom Light's interior is incredibly simple. The lightbulb, reflector and magnetic switch are all fastened to a Lexan baseplate which separates these forward components from the batteries at the rear. Almost all of the electrical connections are brass or copper stamping and are fully exposed for easy cleaning.

The magnetic switch is encapsulated in a sealed metal housing. The reflector unscrews from the Lexan baseplate to allow for easy lightbulb exchange. Because of this extremely simple open-face construction, the Bottom Light can be easily and quickly rescued if it floods. Simply empty out the salt water, flush with fresh water and dry. No damage will result if this is done immediately. The need for extensive factory repair is rare, but parts are available.

The Bottom Light comes equipped with a GE PR-13 lightbulb with an average lifetime of 15 hours. This small, inex-

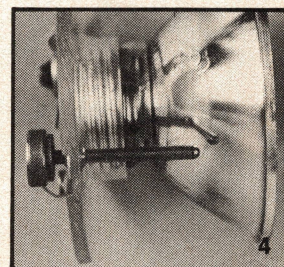
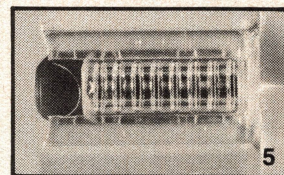
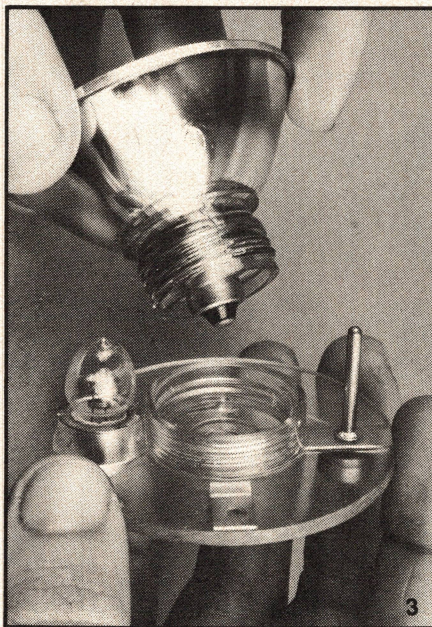




## A MINI LIGHT WITH DISTINCTIVE FEATURES

Text and Photography by Geri Murphy

The Bottom Light, which is only 6½ inches long and 2½ inches in diameter, operates on four C size batteries (1). The transparent nose cone allows the owner to view the front of the batteries (2), extra bulb attached to the baseplate (3) and the magnetic switch (4 & 5). The see-through nose cone also allows for a check of the O-ring seal.



pensive flashlight-type bulb is commonly available in most dive stores, hardware stores and drug stores. An extra bulb is provided with the light, mounted on the baseplate just behind the reflector. This handy storage spot is another one of the Bottom Light's unique features.

### BATTERIES

The Bottom Light is designed to operate on four C size alkaline batteries. They are placed in series so that they are touching head-to-toe (plus-to-minus). In other words, two of the batteries should be placed in the case pointing down, and the other two pointing up. When arranged properly, they will provide the combined power of six volts.

Princeton Tectonics recommends using alkaline batteries for the Bottom Light in order to attain maximum burn time and brightness. Alkaline batteries will last five to ten times longer than ordinary carbon-zinc dry cells. Among the alkaline batteries best suited for the Bottom Light are the Eveready Energizer E93, the Mallory Duracell MN1400 or equivalent. Such batteries (when fresh)

will provide up to five hours of continuous burning light, or up to ten hours if used intermittently. These estimates are based on use with a PR-13 bulb. Ordinary carbon-zinc batteries can be used in a pinch, but the user should be aware that such batteries will only provide about one hour of power.


### PERFORMANCE

The Bottom Light puts out a respectable beam that would please even the most critical light connoisseur. One of the interesting side benefits of the clear front cover is that peripheral light spreads out from the sides. This low level side light illumination is ideal for reading a submersible pressure gauge, depth gauge or dive watch on a night dive.

We found the Bottom Light easy to turn on and off with one hand, with or without gloves or mitts. The sliding magnetic switch has a knurled non-slip exterior. The switch is spring loaded with locking notches in both the on and off positions. The switch must be slightly depressed before it will move in either direction. Incidentally, the spring behind the switch is

also made of Lexan and will never rust. Sand or dirt does have a tendency to accumulate in the switch slot, causing it to jam or bind. However, this can easily be washed out with a hose, under a faucet, or by swishing the light around in water. There are two vent holes at the rear of the switch to allow for flushing. Moving the on/off switch back and forth a few times will prevent salt build-up.

Divers are cautioned never to use aerosol sprays of any type on this light. The propellant (usually carbon tetrachloride or other chemical) used in such spray cans will cause the Lexan to crack or degenerate. Silicone grease should be applied to the O-ring when necessary.

SKIN DIVER's tests indicate that the Bottom Light is simplicity itself and trouble-free in operation. In midnight black, it sells for \$19; the orange version is \$20. (The batteries and wrist lanyard are not included.) Bottom Lights will be available in several other colors in the near future. For more information consult your local dive store or write to: Princeton Tectonics, P.O. Box 764, Highstown, New Jersey 08520. 





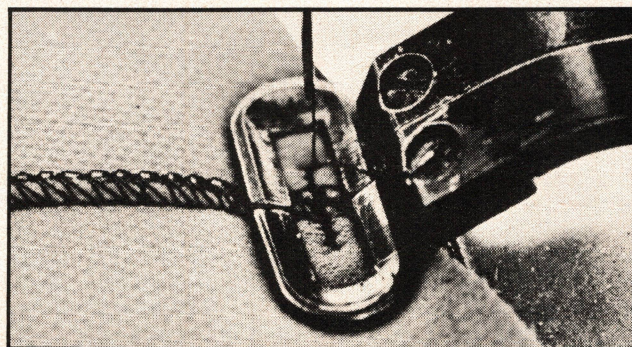
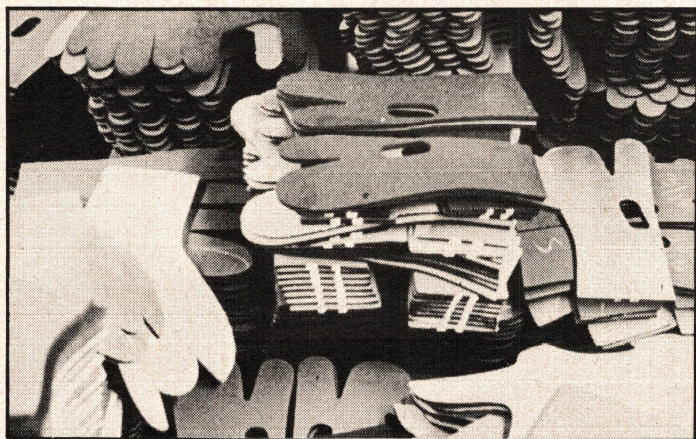
# THE PARKWAY

# STORY



## A QUARTER CENTURY OF QUALITY WETSUITS

TEXT AND PHOTOGRAPHY BY BILL GLEASON



**P**arkway Fabricators is reaching its quarter century milestone in wetsuit manufacturing and the company is planning to celebrate its birthday in the same way it celebrated the previous 24. After the cake is cut, and the party is drawing to a close, someone will bring up The Question, "Is there a better way to make a wetsuit?" For the past 25 years, the answer has always been yes. Frank Sanger, the president of Parkway Fabricators, says, "All of Parkway's



growth is due to innovation, research and development of products for today's divers." And, to really understand and appreciate dive suit manufacturing and innovation, you've got to go through the process step by step.

To begin with, today's divers are different than divers of years past. Not only are they better trained, they're actually physically different. The mythical "average" man or woman has gotten taller, wider in some places and narrower in others. Monitoring these changes over the past 25 years has required Parkway to maintain a lot of statistics, but since diver warmth and comfort are at stake, Parkway feels that it has been well worth the time. Attention to physical anatomy was a Parkway trademark even before the first wetsuit was made back in 1956; manufacturing men's clothing was the mainstay of the company's business in the pre-diving days.

For five years Parkway Fabricators manufactured both men's clothing and dive suits. In the early pioneering days of our sport both divers and manufacturers were feeling their way. Every diver carried a can of black magic wetsuit cement to repair these early suits. Surface intervals were often dictated by the amount of time it would take for the glue to dry so a diver could go underwater again. These years posed tremendous challenges for Parkway Fabricators, since rubber stocks, zippers, and fabrics were not designed with underwater use in mind. Parkway responded by developing the classic Shark Skin Two suit, featuring textured rubber designed to handle the stress of accidental encounters with rocks, barnacles, and the assorted items found in most car trunks. And, the birthday party each year found people with lists of experiments, research projects, and new ideas to make better wetsuits. Manufacturing these became such a challenge that Parkway discontinued its line of men's clothing in 1961 and became a full time dive suit manufacturer.

Parkway utilized the talents of its experienced clothing cutters to pioneer new methods of accurate cutting and quality control on this phase of manufacturing. Since neoprene is much thicker than cloth it soon became evident that very sharp knives were needed to leave smooth, even edges for later gluing. High speed cutting knives were found that provided the necessary tolerances and were incorporated into the manufacturing system. Parkway also discovered that only the best grades of rubber adapted well to the rigors of underwater use. Parkway Fabricators uses only top

of the line, closed cell, nitrogen blown rubber.

From the cutting tables the suits are prime glued and prepared for assembly. Special technicians, working in pairs around large tables, glue the suits a second and third time before actually joining the pieces together. Gone are the days when divers had to carry their own wetsuit cement; triple bonding the seams ensures that leaks will not occur. It's worth noting that glue is applied with pneumatic applicators, another example of how efficiently the staff at Parkway has studied the



**The end result of Parkway's careful construction method is an attractive, quality wetsuit.**

problems of wetsuit manufacturing.

Parkway Fabricators continued its innovative ways through the restless 60's by modifying and adding to its existing product line. Swivel locks, constructed of rust and corrosion proof nickel silver, were an industry first and helped revolutionize the fit of wetsuit jackets, contributing to greater warmth and comfort for the swelling ranks of divers. After the suits have been glued, zippers and swivel locks are applied.

The suit then reaches one of the most visible and important steps in the manufacturing process. The seams, already bonded by three applications of cement, are then sewn by specially modified, industrial grade Strobel machines to give the suit strength and durability. A special lockstitch is used to prevent unraveling and bar tacking is applied to stress points to make doubly sure that the suit will be durable. Quality control checks are strategically located throughout the entire system to ensure uniform quality.

New materials, the latest of which is ly-

cra, all have effects on dive suit manufacturing and Parkway tests many more ideas than ever reach the diving public. This constant testing and searching for new materials has made Parkway Fabricators (since 1969 a wholly owned subsidiary of Great American Industries) the largest manufacturer of underwater exposure garments.

One of the biggest years in Parkway Fabricators' history was 1974 for two different reasons. The first is because that's the year Parkway moved into its present, 30,000 square foot manufacturing plant and distribution center in South Amboy, New Jersey. The second reason is that January, 1974, is the date on which Frank Sanger became president of Parkway. Under Sanger's presidency the corporation has experienced record growth in both sales and innovation. But Sanger brings more than just business acumen and corporate leadership to the company. He has been at the forefront in making a better wetsuit, in changing the way divers dive. Sanger has asked his 120 employees to adopt this corporate philosophy: The motivating factor behind changes and innovations in dive equipment is the enjoyment of the diver. All changes should make diving easier, safer and more fun.

In pursuit of this philosophy Parkway Fabricators has branched out into other areas besides wetsuits. Accessory gloves, hoods and boots are all a part of the product line. Parkway introduced vulcanized boots to the industry, and this year has a new four finger mitt for cold water use. The new glove is designed to combine the dexterity of conventional five finger gloves with the warmth associated with three finger mitts. Glance through the Parkway catalog and you'll find a complete selection of accessory items to complement the line of wetsuits of all types and in all sizes. Colors range from basic black to designer stripes. Materials and options are available for every diver's dream suit, and all have benefited from Parkway's research and development.

In addition to the wetsuit line, Parkway Fabricators is also the distributor for Poseidon Systems in the United States. Poseidon's Unisuit and Jetsuit series satisfies the needs of drysuit divers with a complete line of sizes and accessories. Parkway also is introducing buoyancy compensators and a new regulator, the Cyklon Maximum, in 1981. Parkway Fabricators has certainly come a long way since the day, 25 years ago, when someone asked, "I wonder if a better wetsuit can be made . . .?"



# Technifacts

(Continued from Page 59)

one-quarter inch support chains. Float drums such as these have been used for towing large diameter hoses, pipes, and valves as far as two miles in the open sea. Of course, more than one float can be used. This drum is not intended to raise objects but to keep them afloat once they are on the surface.

A reader in Canada wrote saying, "I found your description of using drums for floats very interesting. We have used an even simpler method of adapting drums for lifting. We make an angle iron fitting about six inches long that will fit into the larger of the plug fittings in the top of the drum. A hole is drilled in the middle of one side of the angle iron. A length of one-quarter inch chain is shackled into the hole. To rig the drum for lifting, remove the two inch plug, insert the angle iron lengthwise into the opening, turn it crosswise with the chain hanging down to the object to be lifted. Then attach the lifting chain and inflate the drum."

This appears to be an instant way of adapting drums to lifting devices. However, there are drawbacks to the method. First, *in actual practice it is almost impossible to control the rate of ascent of the lift* and expanding air must find an escape route from the drum. With only two small holes in the drum to exhaust the rapidly expanding air there is a good chance the drum will rupture as it nears the surface. Secondly, once the drum is on the surface there is no way to vent the air to release the load. Finally, flooding a drum through the small holes to sink it is a slow process. It seems probable that if there is enough equipment available to make the angle iron lifting device, there should be enough to go the few steps further and make a lifting drum as illustrated in Figure #1.

Another reader suggested welding heavy (three-eighths inch diameter) lifting pads or U-bolts to the top of the drum to which chain can be shackled in making a lift. In use, the top of the drum becomes the bottom. Both plugs are removed to sink the drum and for injecting air for flotation. Again, I feel if there is enough equipment (welding and cutting) available to make and attach lifting pads or U-bolts, it would be better to go a step further and make a lifting drum as in Figure #1. Also, the amount of weld material on the one thin edge of the drum and the U-bolt will not be able to withstand the abuse a lifting drum is subjected to in most waters, and particularly in the open ocean.

**CAUTION:** Do not use a torch to cut into or weld on a metal drum of any size until the drum has been properly cleaned

and tested for explosive gas.

Technifacts also received some information on the use of inner tubes as lifting devices. Alec O. Pearce, president, Alpha Underwater Contractors of Englewood, Colorado wrote, "We are commercial divers here in Colorado and the surrounding states. We find your column very informative and well illustrated. Enclosed please find a sketch for a lifting device made from a car inner tube. Maybe it could be passed on to your readers." This is illustrated in Figure #3.

Another reader suggested an even simpler method of using an inner tube as a float device. A one-quarter inch chain is pulled through a piece of rubber hose of appropriate size and length. This is then passed around the inner tube (Figure #4). The tube is completely deflated, lowered to the object to be lifted, secured with the chain and the tube then inflated. An objection to this device is that the amount of initial inflation must be only a fraction of the total displacement of a completely filled tube due to the expansion of air in the tube as it rises through the water.

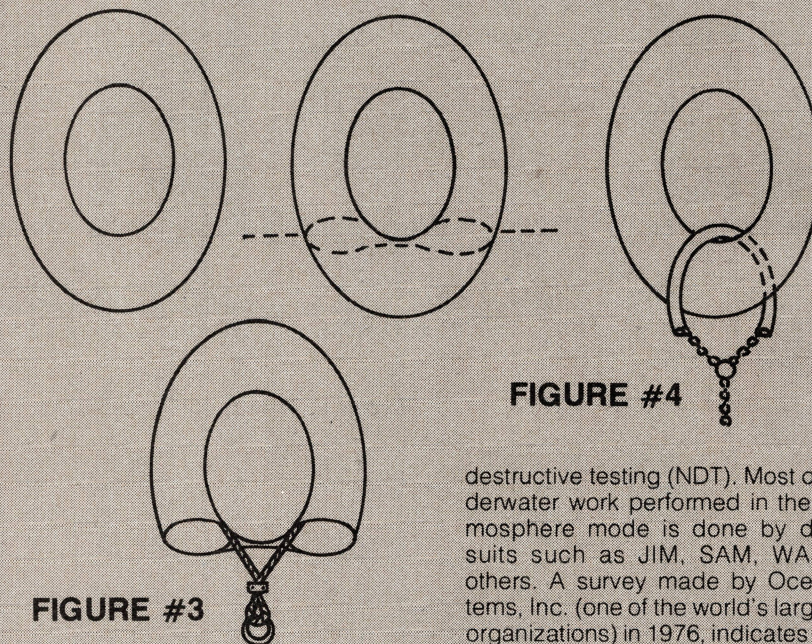


FIGURE #3

FIGURE #4

To inflate any lifting device, a low pressure air compressor on the surface with an air hose can be used. The air hose should be fitted with a valve to control the flow of air into the flotation device. Another method is to use a scuba cylinder with the first stage regulator of a single hose system. Remove the second stage and in its place attach a small valve with a press-to-open handle (most welding stores have these). The standard inner tube, with air fitting still intact must be inflated with a regular service station tire filling fitting. This can also be attached to the hose of a single hose regulator after the second stage has been removed. The scuba tanks can be lowered on a line or the diver can swim them down to the job.

For readers who have access to SKIN DIVER Magazine for September, 1970, there is a short article by Wade Doak on construction of a collapsible lift bag of canvas and other material. Also for your information, M&E Marine Supply Co., P.O. Box 601, Camden, NJ 08101, carries a supply of collapsible float bags in most sizes. NAUI News for October/November, 1980, page 6, has a brief discussion of lift bag design from the standpoint of pressure/volume ratios.

## RSV's, ROV's, AND JIM

"As a commercial oil field diver let me first thank you for your informative column. Keep up the good work. I also have a question for you. How widespread is the use of deep diving submersibles and other one atmosphere systems, in the commercial diving field? What are the indications for their future use?"

At present I believe about 25 percent of all underwater work is being done by various types of remote controlled, diverless, vehicles or with one atmosphere systems such as JIM, WASP, etc. Most of this work is, at present, in the area of non-

destructive testing (NDT). Most other underwater work performed in the one atmosphere mode is done by divers in suits such as JIM, SAM, WASP and others. A survey made by Ocean Systems, Inc. (one of the world's largest dive organizations) in 1976, indicates that diverless support systems, manipulators, and special tools could perform up to 80 percent of all diver's tasks. The development of shirtsleeve underwater production systems in which the operators are transported at one atmosphere pressure to and from the undersea production system in a personnel transfer capsule (PTC), will be another development that will increase the diverless support system. However, as stated in a previous Technifacts, offshore oil companies are finding the best use of remote operated vehicles and manipulators is often in conjunction with conventional divers. The trend will probably be toward remote diverless systems at first and then the use of divers in conjunction with mechanical systems. Technifacts hopes to develop more on this in later issues. ✕



# SDM travel

## SECTION

**T**ruk Lagoon: The relatively shallow waters of the 40 mile wide lagoon are studded with palm covered volcanic and coral islands like emeralds in some exotic crown. The water, all shades of blue, laps lazily at the shores where beautiful, black-eyed children splash and gambol in its welcoming warmth.

Inside the encircling reef, the sea shimmers as the sun glances from its wind ruffled surface, dotted with small white boats scooting rapidly between islands, taxiing commuters to and from their work.

There is an ambience of tranquillity here: Friendly, smiling people; soft, gentle breezes; lush, trailing vines. Even the rain cooperates, turning the water to the gray iridescence of beaten pewter.

Yet, beneath this idyllic exterior, lying on the bottom of the ocean, are broken, rusted, pitiful remains; mute testimony to the violent destruction which sent more than 50 ships and over 30 planes of the Japanese Imperial Fleet to their final destination.

Colors on the metal reefs are mirror images of the colors of that battle fought above: Blue of sea reflects blue of sky; beckoning polyps repeat, in miniature, the flickering orange of flames; red algae imitates flowing blood; and even smoke has its counterpart in the ochre silt stirred by divers' fins as they swim by.

Motion conspires to complete the image: Darting fish are bright echos of attacking planes; slight surge could be the jarring impact of distant bombs. The terror which must have accompanied such a battle lurks nearby in the form of hovering sharks, a more subtle fear perhaps, but still an awareness of danger. War created these reefs. It seems appropriate somehow that the scene should reflect its cause.

Off Fefan, down the anchor line of the dive boat, is the *Yamagiri Maru* in

110 feet of water. She is intact, resting on her port side; alive with anemones, clams, corals, algae, and vibrating with the continuous movement of snappers, butterflyfish, tuna and damselfish. In her empty holds is a pile of 18 inch shells, the largest shells produced during World War II. Her name is visible on the bow at 70 feet

### TRUK LAGOON An Underwater Monument

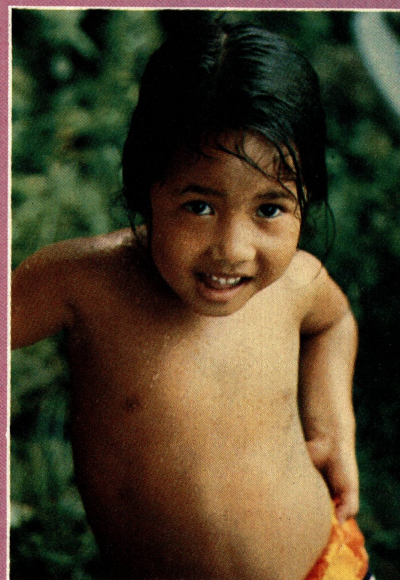
Text and Photography  
by Nancy Ferguson



and her bow gun still points menacingly in spite of the growth on it.

The *Heian Maru's* name, in both English and Japanese, is plainly visible on her starboard bow. In a companionway off her sloping, mangled bridge are periscopes and various china cups and dishes. Outside, away from the gloom, are sponges in unlikely technicolor, living with striped Moorish idols who trail their dorsal fins like streamers through the clear turquoise water. *Heian* means peace.

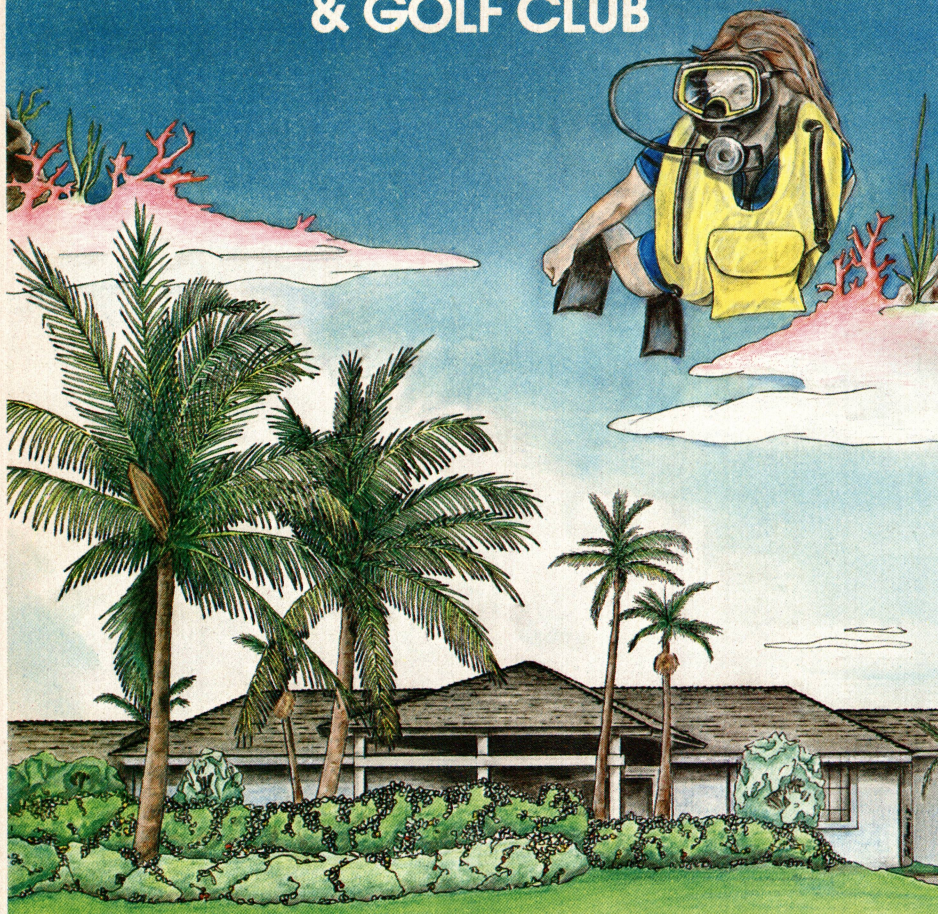
Half the *Sankisan Maru* was blasted into fragments; the other half lies in exquisite isolation; coral covered anchor and chain fasten her permanently in place. Ammunition is scattered across number one hold and trucks share deck space with an astounding array of brilliant corals and sea anemones.



Farther north, near tiny Eten, two masts rise mysteriously into the air. They indicate the *Fujikawa Maru*, a converted aircraft transport whose corridors, passageways, and railings bear a profusion of corals; awesomely beautiful, almost obscuring the machine guns, engine parts and shells. One of her masts hosts clouds of blue chromis, and in the arms of ane-



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## TRUK LAGOON

mones, clownfish dash to and fro, protecting their territory from a diver who aims nothing more harmful than a camera.

Magnificent angelfish dwell in enviable harmony with jacks, groupers, and wrasses aboard the *Shinkoku Maru*. Uniforms, shoes, boots, and all sorts of personal belongings create an eerie, tragic atmosphere of desolation; emphasized by human bones in a silt covered cubicle 100 feet down.

Occasionally a diver will pick up a cup or glass, examine it with something akin to reverence and carefully put it down again. Each item, in its own way, represents the whole, which has been declared an underwater monument; it would be disrespectful to disturb anything here.

So people come to look, to photograph, and to wonder at the abundance and generosity of nature that can produce, from death, such a glorious wealth of life.

## OCEAN DIVER COMPLETED

Ocean Divers has completed the *Ocean Diver*. It has bunks for ten people, with storage beneath each one. There is an Onan 15kw generator, a Poseidon 7cfm compressor, and a complete complement of electronics including a Furuno radar, a Hull single sideband radio, a Motorola VHF radio, and a Sitex recording fathometer.

The 50 foot Marine Management hull has a spacious afterdeck for dive and photo gear. Water entry is easy with the walk-through transom and a large dive platform. There is an inflatable on board for safety; to ferry divers ashore in the evening; or for water skiing.

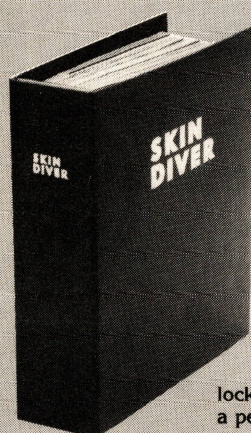
The *Ocean Diver* is available for charter on the following dates: May 2 and 11, June 6, July 11 and 20, August 1 and 10, September 5, 14, 21 and 28.

Areas available for charter are Bimini, Cay Sal Banks, Dry Tortugas (Fort Jefferson), and overnight along the keys. Trips planned for three or five days, departing Saturday am and returning Monday pm or departing Monday am and returning Friday pm.

For brochure and schedule of trips write to: Ocean Divers Inc., P.O. Box 1113, Key Largo, FL 33037; (305) 451-1113.



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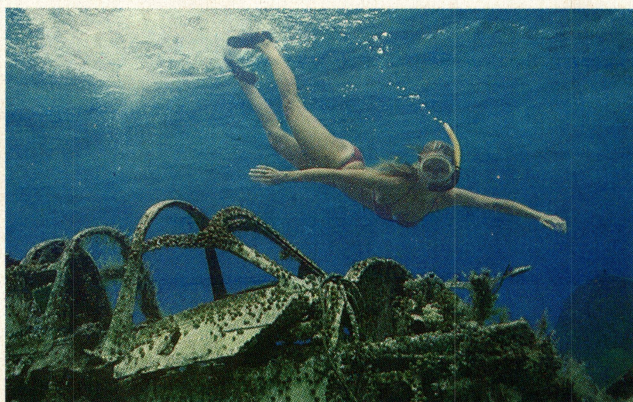
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**CONTINENTAL**  
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SK-3

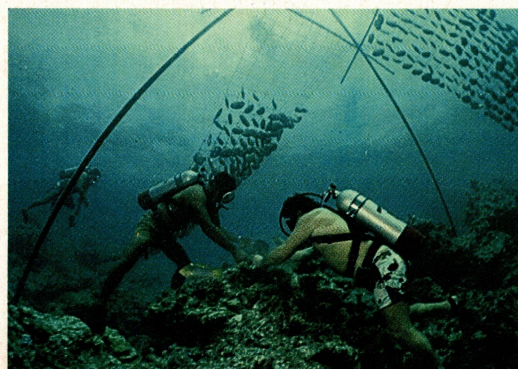
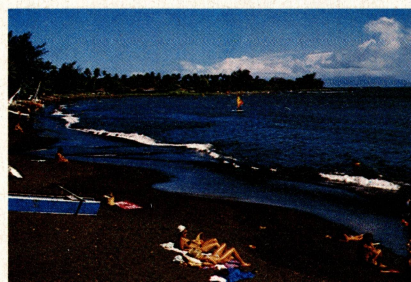




# Manihi

south seas fantasy island

Text and Photography by Bob and Nancy French



Tahiti. French Polynesia. The South Pacific. All these words conjure up visions of the island paradise that has inspired masterpieces of art and prose.

But what about underwater?

Can the underwater world of such a retreat possibly offer comparable beauty? We were not to know the key, the proverbial French Connection, which would allow us to discover the response to this question until we visited a new resort for divers — Kaina Village.

UTA Air France's flight from the gateway city of Los Angeles was accented with migrants of all shapes, sizes and interests traveling to their respective South Pacific fantasylands. Each of their final destinations represented something different for each voyager: A place to find romance; relax; snorkel or maybe even scuba dive.

**Accommodations at the Kaina Village resort on Manihi consist of bungalows which are known as fares. These huts are situated on stilts over shallow water. Each fare is individually decorated in local ethnic style and each has a different view of the lagoon. The resort itself is reached by skiff.**



Tahiti itself is an island in French Polynesia located halfway between California and Australia (or Santiago and Tokyo, whichever perspective you may choose). Kaina Village is located on Manihi, an atoll in the island group known as the Tuamotus. Approximately 310 miles north and east of the island of Tahiti in French Polynesia, Manihi's population is slightly over 300.

Air Polynesian took us from Tahiti, an impressive, "high island," obviously volcanic in origin, to our destination — Manihi. The plane's route took us over a small village on the atoll and then, on its way to the airport, over the resort. From the airport we were taken to Kaina Village by small skiffs. As our water taxi pulled out from the cut in the atoll behind the landing strip, we could see the lights of the resort.

After months of awaiting our trip to this new divers' paradise, this aquatic approach by the light of the full moon and its complement of stars just added fuel to the fire of our anticipation. We'd been intrigued by the reports of the diving here on Manihi and were most anxious to experience it ourselves.

Upon arrival, we were proffered a welcome refreshment and assigned to our respective rooms. Accommodations were bungalows, or fares, situated on stilts over shallow water inside the atoll. Each chamber was individually and tastefully decorated with ethnic memorabilia; each fare afforded a distinct, private perspective of the lagoon. The calming effect of the water lapping at the base of our bungalow mollified our spirits and allowed us to rest up before our first day of diving.

After breakfast and an informative session at the black pearl farm located in Manihi's little village, we made our first dive: We visited the pearl farm's underwater operation. We still awaited our dive in the promised fantasyland.

Another special repast was prepared and served in the open-air dining hall by our Tahitian-Chinese hostess, Mareva. After lunch the scuba divers again were loaded into two of Kaina Village's launches. According to our bilingual dive-master — many of the resort's guests speak French — our next venture was to dive "the cut" in the atoll.

Many of our dives in the next several days were made in or near this auspicious dive site. No matter from what vantage point we experienced the cut, it always came out the same: The diving in this 86 degree water was spectacular.

Corals were heaped atop other corals. Both the size and numbers of table corals

alone were impressive. And each crop of corals housed many other inhabitants: anemones and their symbiotic clownfish; schools of skittish squirrelfish; *Tridacna* clams resplendent in their iridescent mottled blue, brown or green. Chances were, on a single coral head, one would encounter not only one or two, but 30 or more Christmas tree worms.

Passing schools of fish mesmerized us — each school boasted scores of denizens. With a couple hundred feet of visibility, this simply meant the overwhelming possibility of envisioning 1000 piscine creatures at a mere glance. The variegated butterflyfish seemed to come in every color combination and proclivity. The graceful motion of these schools alone offered sweeping bursts of color over the otherwise somber hues of the corals in the pass. Impressive numbers of unicornfish, surgeonfish and tangs traveled together. This was fantasy diving at its finest.

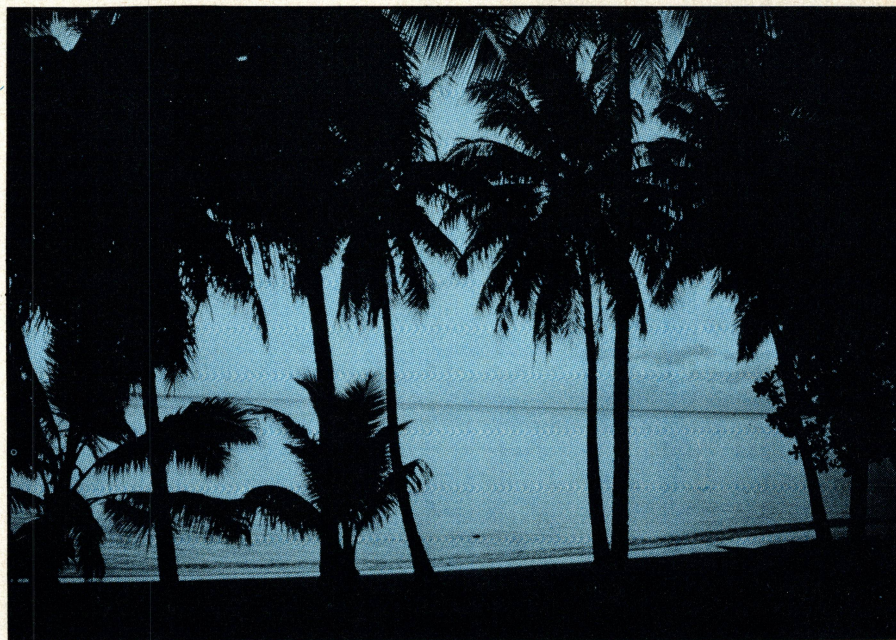
In between the fine meals of seafood and continental cuisine that Mareva bestowed on us and the dives in Manihi's coral cut, we did experience more of Manihi's underwater terrain — both inside and out of the atoll. Inside the atoll the water remains at about 86 degrees on the surface and constantly calm. Manihi proved to be quite perfect for divers: The pass was on the lee side of the atoll and

allowed good diving to be a reality on a consistent basis. Visibility wasn't quite as good here, though there were massive coral colonies, a plethora of fish and good shelling.

Outside the atoll we experienced beautiful drop-offs, shy but colorful groupers, a school of peaceful sharks, clumsy puffers, and a manta ray with a wing span of about 20 feet and a bevy of its own remoras. Water temperature here dropped down to about 80-81 degrees.

After a week's stay at Kaina Village diving, shelling, snorkeling and picnicking on deserted beaches, we returned to Papeete for two days to await our return flight to Los Angeles and assimilate our visit. Consensus was that we hadn't been disappointed. It was the combination of elements which created the uniqueness of this trip — incredible diving, beautiful topside scenery in an idyllic Pacific island, good food and charming accommodations. All added up to a true fantasy island trip.

Tours to Manihi and Papeete are currently being offered to divers and non-divers alike. The only requirement for the tour is a desire to experience a fantasy on a remote, South Pacific island. Any inquiries for same may be directed to: Sea Safaris, 3701 Highland Avenue, Suite 304, Manhattan Beach, California 90266.



The quiet waters lapping on the sandy shore of the lagoon and the bordering palms make a classic setting for the end of a day on Manihi. This idyllic tropical atoll is in the Tuamotus group and is approximately 310 miles northeast of the island of Tahiti. Manihi is easily reached by Air Polynesian from Tahiti but still retains an isolated atmosphere.



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The second program, Shell International Course for Diving Emergency Physicians will be held on May 2-9. This course will be under the direction of David H. Elliott, M.D., of the United Kingdom.

The meeting planner for both trips is Helen Turcotte of Medical Seminars, Inc. who will coordinate all travel and diving arrangements. For a complete brochure and academic schedule, contact: Medical Seminars, Inc., P.O. Box 530441, Miami Shores, FL 33153; phone (512) 492-5656.



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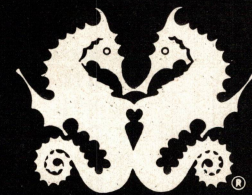
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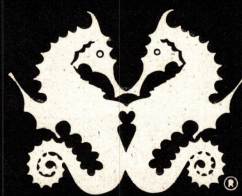
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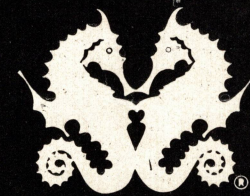
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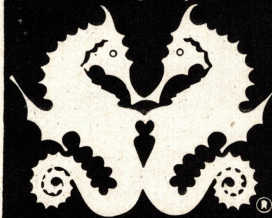
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BALA CYNWYD, PA. 19004, Phone 215-649-7877

Name \_\_\_\_\_ Age \_\_\_\_\_  
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City \_\_\_\_\_ State \_\_\_\_\_ Zip \_\_\_\_\_  
Interested in family rate of 3 or more \_\_\_\_\_  
Starting date choice of \_\_\_\_\_ (if known)



The resort package is \$699, which includes an air-conditioned room (double occupancy) for four nights; three nights aboard the *Mohawk II*; six days of diving; all breakfasts and lunches; and all package gratuities and tax. Not included are diving on arrival and departure days and dinners for six nights. The *Mohawk II* will pull into port for two dinners at other islands.

For non-diving guests accompanying students, the resort package is \$469. It also includes an all-day sail to St. John aboard the *Ho-Tei* (a 53 foot catamaran), an island tour, a visit to Coral World and an introductory scuba lesson if desired.

For further details, write directly to: Jim and Cathy Church, P.O. Box 80, Gilroy, CA 95020, or phone: (408) 842-9682. 🐠

## HUB U/W MEDICINE COURSE

Israel and the Red Sea will be the sites of an advanced Diving Medicine in Depth program for physicians October 23-November 8, 1981. The course will be conducted by Human Underwater Biology, Inc., headquartered in San Antonio, Texas.

The program is fully accredited and approved for Category I Continuing Medical Education Credits by the American Medical Association through the Undersea Medical Society.

A sight-seeing excursion in Jerusalem will be followed by one week of diving in the Red Sea with optional trip extensions available at the conclusion of the course.

Diving services will be provided by Red Sea Divers at their Sharem-el-Sheikh location.

For complete information and registration, contact program coordinator, Dept. 1267, Human Underwater Biology, P.O. Box 5893, San Antonio, TX 78201, (512) 492-9395. 🐠

## RED CARPET INCREASES FLIGHTS

Red Carpet Airlines has increased its scheduled flights between Tampa, Grand Cayman and Cayman Brac. The new schedule, effective December 15, provides six flights to Grand Cayman; five of the flights are non-stop from Tampa and one is a non-stop to Cayman Brac which continues on to Grand Cayman.

Also effective December 15 from Tampa to Grand Cayman was a 14 day round-trip inclusive tour fare of \$155.

The 21 day excursion fare between Grand Cayman and Cayman Brac is \$50.

For reservations and further information, call Red Carpet Airlines; Grand Cayman at 95347; Cayman Brac at 87335; nationwide toll free at (800) 237-9940; in Florida toll free at (800) 282-8137; or in St. Petersburg at (813) 535-5541. 🐠



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Off shore, superb diving is just 5 minutes from dockside. Plunge 80' over Chub Cay Wall, home of eagle rays and schooling jacks; explore Canyons & Caves, a maze of cuts and caverns, teeming with tropical fish; or snorkel Mama Rhoda Reef, a forest of elkhorn & staghorn corals.

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# United States Virgin Islands

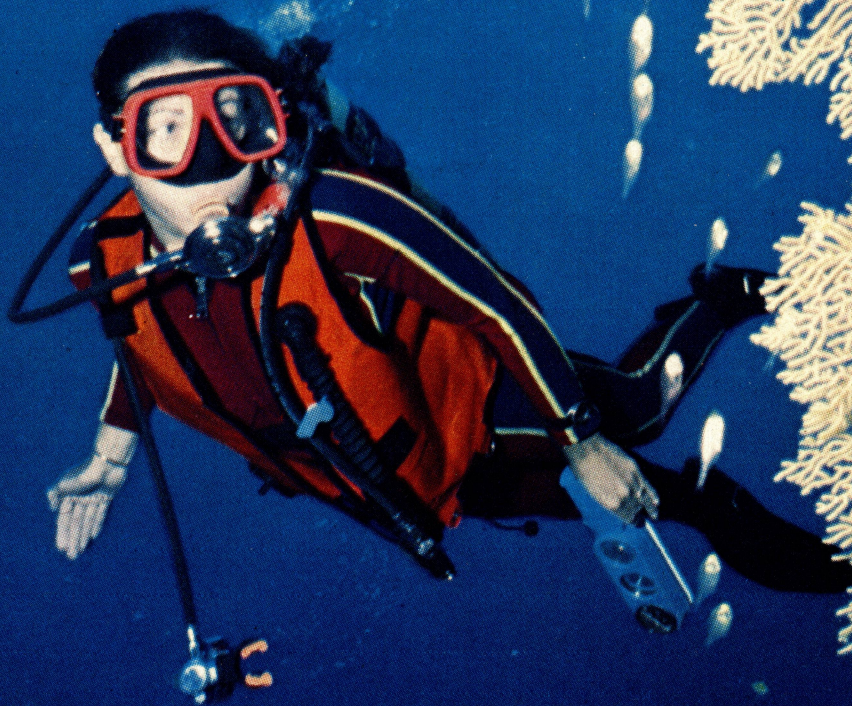


Photo: Bret Gilliam, V.I. Divers, Ltd.



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"Skin Diver," Jan. '80

"...the most popular dive resort destination in the world." That's how "Skin Diver" magazine rates the United States Virgin Islands. Write directly to the dive centers listed below for details in their area. For a copy of our 24-page "1981 Dive Guide to the Virgin Islands" write to the Division of Tourism at the address below.

## St. Croix:

Above & Below, 12 Strand Street, Frederiksted 00840. Tel.: (809) 772-3701  
Caribbean Sea Adventures, Kings Wharf, Christiansted 00820. Tel.: (809) 773-5922  
Cay Divers, Box 3234, Christiansted, Tel.: (809) 773-5907

North Star Dive Tours, Box 3461, Christiansted 00820. Tel.: (809) 778-2125  
Pressure Ltd., Box 3612, Christiansted 00820. Tel.: (809) 77-DIVER  
Salty Dogs Inc., 59 Kings Wharf, Christiansted 00820. Tel.: (809) 773-2678

V.I. Divers, Ltd., PanAm Pavilion, Christiansted 00820. Tel.: (809) 773-6045

## St. John: (Zip Code 00830)

St. John Watersports, Box 70, Cruz Bay, Tel.: (809) 776-6256

Scuba Ventures, Box 120, Cruz Bay, Tel.: (809) 776-6111

The Dock Dive Shop, Cruz Bay, Tel.: (809) 776-6338

## St. Thomas: (Zip Code 00801)

Aqua Action Inc., Wintberg Peak, Tel.: (809) 775-3275

Bolongo Bay Beach & Dive Club, Box 3381, Tel.: (809) 775-1800

Caribbean Divers, Red Hook, Tel.: (809) 775-1935

Dive Locker, Harms Marina, Red Hook, Tel.: (809) 775-3110

Frenchman's Reef Watersports Centre, Tel.: (809) 774-8500 ext. 353

St. Thomas Diving Club, Box 4976, Tel.: (809) 774-1376

Underwater Safaris, Box 7970, Tel.: (809) 774-1350

Virgin Islands Diving School, Box 9707, Tel.: (809) 774-8687

Joe Vogel Diving Company, Box 7322, Tel.: (809) 774-2321

Watersports Center, Box 2432, Tel.: (809) 775-0755

## United States Virgin Islands St. Croix • St. John • St. Thomas

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## TROPICAL ADVENTURES

Tropical Adventures is the new name adopted by Bob Goddess for his company specializing in "unique dive trips for the active oriented."

Tropical Adventures (formerly known as the Goddess Agency) is scheduling trips during 1981 to Fiji, Mexico, Bahamas, and Central America.

For information, contact: Bob Goddess, 624 Joshua Green Bldg., Seattle, WA 98101. ☛

## SEE & SEA EAST OFFICE

Gateway of the Caribbean, Ft. Lauderdale is the location of See and Sea's new East Coast office. Heading it will be Captain Paul Humann, who was recently appointed Caribbean sales manager. With eight years experience as captain of the M/V *Cayman Diver*, he became an expert in dive travel in the Caribbean.

The office address and phone are: See and Sea Travel Service, P.O. Box 350127, Ft. Lauderdale, FL 33335. Telephone (305) 983-0599. ☛

## SAVM MEETING

The Society of Aquatic Veterinary Medicine (SAVM), composed of approximately 300 members from the U.S. and Canada, is holding its annual spring meeting March 7-14 at Stella Maris Inn, Long Island, Bahamas.

Members of this organization are diving veterinarians who are dedicated to furthering the study, appreciation and understanding of marine biosystems as they relate to veterinary science. To accomplish this goal, two dive meetings (one spring and one fall) are scheduled each year.

Anyone desiring information about this group or its trips should contact: Jim Peddie D.V.M. Vice President, 2107 Trentham Rd., Thousand Oaks, CA 91361. ☛

## DIVING LTD. EXPANDED

Bob Soto's Diving Ltd., Grand Cayman's largest dive operation, and the oldest sport diving organization in the Caribbean, has undergone a complete reorganization and expansion under the directorship of Ron Kipp, who recently purchased majority shares in the operation.

Most noticeable is the complete redesign of the North Church Street dive headquarters in George Town, Grand Cayman. The headquarters now features over 400 square feet of retail space, and complete lines of both Dacor and Scubapro equipment. In addition, the headquarters houses the corporation's executive offices; a large compressor room featuring an August Ahrendts com-

pressor and an entirely new Mako air storage, filtration, and distribution system; a complete workshop for dive equipment service and repairs; completely new docking facilities; and the only marine fuel distribution center on the west side of Grand Cayman.

Upcoming additions to the dive headquarters include a complete rental facility for tanks, regulators, weights, backpacks and dive floats for shore diving.

"By centralizing our compressors, boats, workshops and offices at the North Church Street headquarters, we can streamline our hotel operations at the Grand Caymanian Holiday Inn, Beach Club Colony, and Cayman Islander hotels," Kipp said.

In addition to scuba diving, Bob Soto's Diving Ltd. features daily snorkel trips, glass bottom boat trips, windsurfing and Hobie Cat sailboat rentals. The dive organization has announced its intentions to expand into new Cayman Island hotel properties.

For more information, write airmail to Ron Kipp, Bob Soto's Diving Ltd., P.O. Box 1801, Grand Cayman, B.W.I. ☛

## CAYMAN-WESTERN FARE

Cayman Airways is offering its \$339 round-trip 14 day excursion airfare between California and Grand Cayman in conjunction with Western Airlines as well as with Eastern Airlines and National Airlines.



Western is offering the joint fare from Los Angeles, San Diego and/or San Francisco through Cayman Airways' Miami gateway; Eastern Airlines offers its joint fare from Los Angeles and/or San Francisco through Cayman Airways' Miami gateway; and National Airlines offers its from Los Angeles, San Francisco and/or San Diego through either Cayman Airways' Miami or Houston gateways.



At the same time, Cayman Airways is offering a 14 day return excursion fare of \$374 from Los Angeles or San Francisco through Miami and Grand Cayman to Cayman Brac and/or Little Cayman, also in conjunction with any of the three U.S. carriers.

For reservations or further information, phone Cayman Airways reservations nationwide toll-free at (800) 327-2864; in Florida toll-free at (800) 432-2180; in Miami (305) 446-8696 and in Los Angeles (213) 738-1969. ☛



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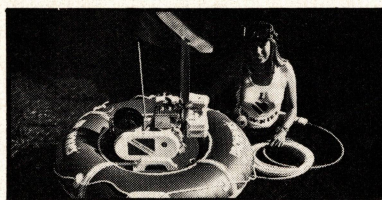
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## MOORE TOURS GRAND CAYMAN

With its tropical climate and excellent diving conditions all winter long, Grand Cayman Island in the British West Indies is enjoying a particularly healthy high season this year. From December 1 through April 30, the most popular time of the year for visiting the island, Moore Tours offers three, four and seven-night tours which include round-trip airfare, hotel or condominium accommodations, airport transfers, tennis, tips and taxes. Special options include professionally guided scuba excursions as well as lessons for beginning divers.

Moore Tours offers accommodations in three popular beachfront hotels on the island's famous Seven Mile Beach — the Grand Caymanian Holiday Inn, the Coral Caymanian and the Galleon Beach Hotel. In addition, tourists can choose from one or two-bedroom condominiums on the beach at Villas of the Galleon.

Moore Tours also has a full-time local representative on Grand Cayman Island to provide a wide array of travel services. For more information, contact a professional travel agent or write Moore Tours at P.O. Box 7450, Dallas, TX 75209.

## ADVANCED DIVE CHARTERS

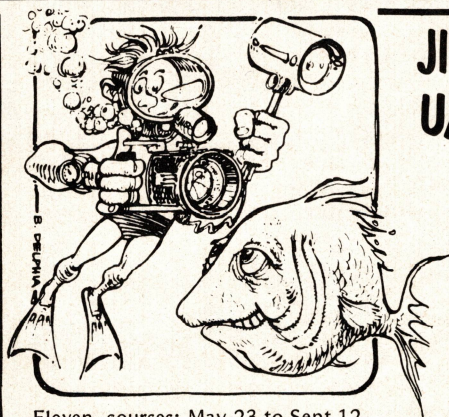
Captain Franco Piacibello, owner of Reef Raider's Dive shop in Key West, Florida, has announced that the shop's Advanced Dive Charter Program is now in full operation.

The program is headed by Billy



Deans, Reef Raider's special project manager. Billy is a licensed Ocean Operator, YMCA, PADI scuba instructor, and has over ten years of charter diving experience in his hometown of Key West.

For further information concerning the Advanced Dive Charter Program, contact Capt. Franco Piacibello or Capt. Billy Deans at (305) 294-0660 or write Reef Raider's Dive Shop, US #1 Stock Island, Key West, FL or 109 Duval Street, Key West, FL 33040.



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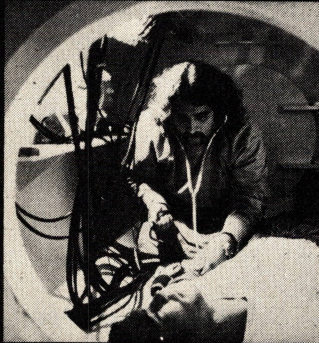
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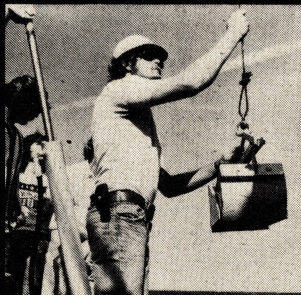
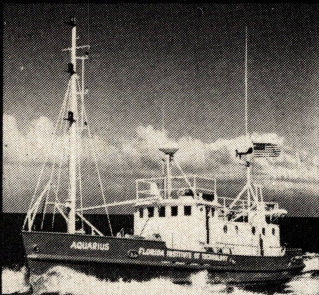
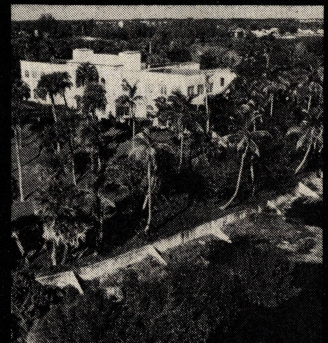


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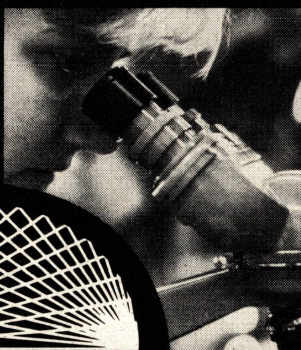
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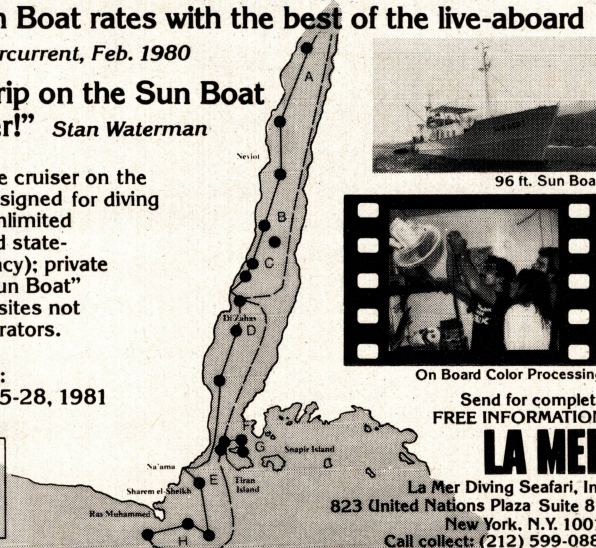
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## LA MER/EUGENIE CLARK TO RED SEA

La Mer Diving Seafari has organized a special 23 day Red Sea expedition and aerial photography seafari with Dr. Eugenie Clark. Dr. Clark, a professor of zoology at the University of Maryland, is a well known authority on shark behavior. Scheduled for July 5 through July 28,



1981, with departure from New York, this is the third in a series of unique scientific and educational voyages hosted by La Mer. The expedition members will live aboard the specially equipped, comfortable, 96 foot, *Sun Boat*.

Amos Nachoum, divemaster for the trip, stated, "The purpose of this expedition is to document photographically the state of conservation and the condition of the Straits of Tiran, Ras Muhammed and the Sinai Reef during the last period of Israeli occupancy. While Dr. Clark will be concentrating on the study of shark behavior, she will also observe the condition of the coral reefs and the indigenous fish living on them."

For further information and reservations, please contact La Mer Diving Seafari, Inc., 823 United Nations Plaza, Suite 810, New York, NY 10017 (212) 599-0886. ✉

### U/W CAMERA RENTALS

Marine Graphics is now renting underwater motion picture cameras for professional use. This new venture is in addition to the company's own film production and underwater cinematography services.

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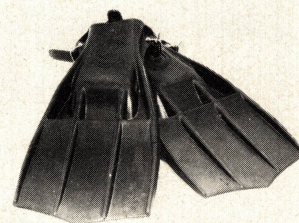
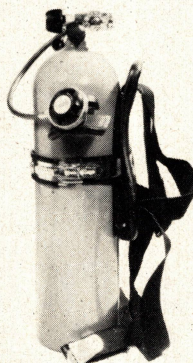


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# RX FOR DIVERS

BY CHARLES V. BROWN, M.D.

## LUNGS UNDER PRESSURE PART I

**W**hether engaged in breath-hold or scuba diving, when you're under water, your lungs are under pressure. So long as the pressure within them stays close to ambient, no harm results. If it deviates much from ambient in either direction, the consequences can be grave. Pulmonary barotrauma is the technical term for lung damage caused by pressure. While most divers know about lung blow-out, some other consequences of over-pressure, and those of under-pressure, are not common knowledge.

### LUNG UNDER-PRESSURE

The lung is designed for variable volume, but there are limits. If you go too deep without adding air to equalize pressure, a relative vacuum will develop in the lung just as it would in the middle ear. This is the traditional picture of lung squeeze as described in the older dive manuals. It's simple in theory. Total lung capacity is usually four to five times residual volume — the volume of air left in the lungs after full exhalation. A breath-hold diver fills his lungs at the surface. As he descends his chest gets smaller, compressing the air. Residual volume is reached at four to five atmospheres absolute — somewhere between 99 and 132 feet. Beyond that depth the chest can't get smaller. Increasing ambient pressure then compresses the air to below residual volume by squeezing extra blood into the lungs. The distended

pulmonary capillaries leak water into the lung tissue and the alveoli. This is pulmonary edema. It makes the lungs stiffer so it's harder to breathe, and it interferes with gas exchange. Distended further, the capillaries rupture and bleed into the alveoli.

The theory was put to the test in 1968 and it flunked. Bob Croft of the U.S. Navy, made a breath-hold dive to 240 feet without ill effect. Trained breath-hold divers have larger lung capacities and smaller residual volumes than do other people, so they could probably go deeper than 132 feet before reaching residual volume, but certainly nowhere near 240 feet. Die-hard physiologists postulated that Bob was some sort of freak with unusual lungs. Then, Jacques-Mayol and Maiorca exceeded 300 feet and it was definitely back to the drawing boards.

The fallacies in the theory were assuming that residual volume would be the boundary between no-squeeze and squeeze, and underestimating the elasticity of the pulmonary capillaries. If residual volume is reached at 132 feet, it only means that the chest volume is as small as the diver can make it by voluntary effort. Unbalanced sea pressure can make it smaller by pushing the chest wall in and the diaphragm up. Far more important, the pulmonary capillaries are highly elastic and tolerate rather a lot of distension before they leak much fluid or rupture and bleed. How quickly pulmonary edema develops depends on the degree of under-pressure, time of exposure and individual susceptibility. So lung squeeze in the traditional sense probably doesn't happen, since nobody can dive deep enough for long enough.

Two cases of lung squeeze, not of the traditional sort, have been reported. In the first, a scuba diver (for reasons unknown) blacked out underwater. His lungs assumed their normal resting volume, which is closer to residual volume than to full expansion. This left him negatively buoyant, and he fell through the water without inhaling. He was rescued and revived, but had severe difficulty breathing and soon died. Autopsy did not indicate drowning, but did show pulmonary edema.

The second case involved a scuba diver who was too buoyant at the surface. He'd be OK at the planned dive depth because the gas bubbles in his wetsuit material would be compressed. He was a bright engineer, and instead of struggling to get down, he decided to

employ Archimedes' principle. He exhaled completely to reduce his buoyancy, and without inhaling, descended easily to 20 feet. Suddenly he could barely breathe. He, too, was in acute pulmonary edema. With emergency treatment and three days in the hospital he recovered, and has since resumed diving. His medical history did include coronary artery disease, which may have been a predisposing factor.

How can such short drops bring on lung squeeze with pulmonary edema when much deeper dives do not? The argument against lung squeeze fails if the lungs aren't full when descent begins. Look at the arithmetic. If a diver who starts with a full breath reaches residual volume at 132 feet, he'll have to go all the way to 298 feet (doubling the ambient pressure) before his lungs are com-

pressed to half of residual volume. But if he starts after exhaling completely, he'll reach half of residual volume at only 33 feet. World class divers might briefly tolerate this much squeeze stress, but it seems unlikely that ordinary mortals would.

Our engineer may have been subjected to even greater squeeze stress at only 20 feet. He was already immersed in the water when he exhaled and started down. The hydrostatic pressure of the sea balances the effect of gravity on blood; upon immersion, more than a pint shifts from the lower body into the chest, displacing air from the lungs. Cold-induced constriction of vessels near the body surface, and any elastic tension exerted by the wetsuit, increases the amount of blood shifted. Thus, descent began with his lung volume already well below what residual volume would have been on land — a big head start toward squeeze. In addition, he'd just finished a previous dive, which may have involved significant negative pressure breathing.

Relative vacuum is the essence of squeeze, and negative pressure breathing is another way to achieve it. If you duck three or four feet below the surface and breathe through a long snorkel, your lungs will be squeezed because the pressure within them (one atmosphere) is well below ambient. You'll find it extremely difficult to inhale against that much negative pressure — which is fortunate. If you were strong enough to breathe through that snorkel, your lungs would soon fill with edematous fluid and blood.

(Continued on Page 86)



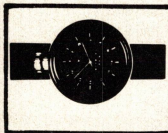
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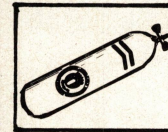
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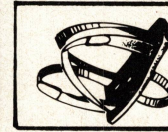
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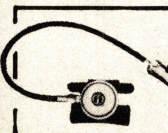
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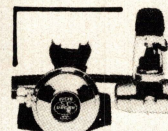
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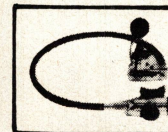
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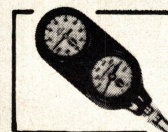
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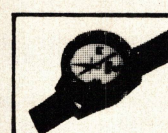
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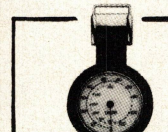
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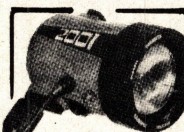
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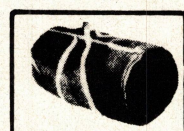
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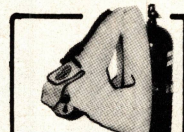
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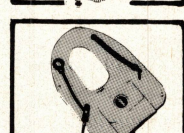
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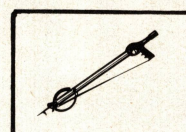
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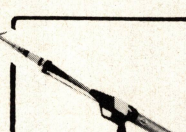
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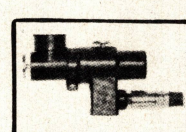
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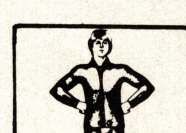
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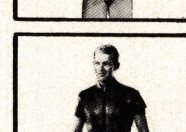
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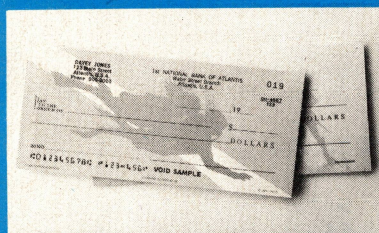
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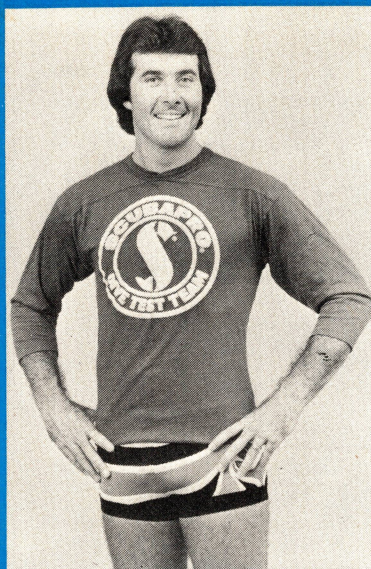


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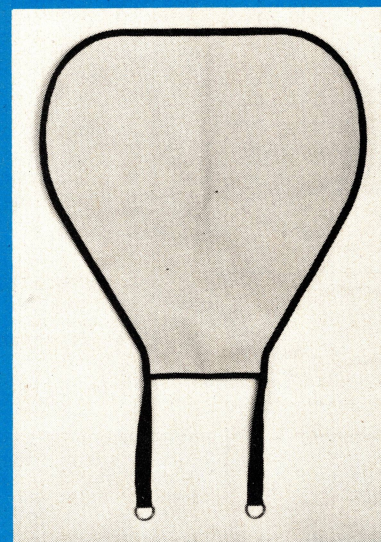
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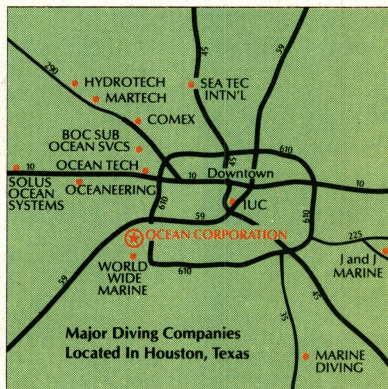
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The Ocean Corporation is located in Houston and more commercial divers are hired in Houston than in any other place in the world. Twelve diving companies are located in Houston including three of the four largest in the U.S. Many others are located in the nearby New Orleans area. The demand for divers is so great in Houston that large locally based diving companies like Ocean Systems, Hydrotech Systems, Martech International and Sea Tech International have hired many of our students for part-time work while they were attending school. Over 90% of our recent graduates went to work for these and other local diving companies when they completed our program. Houston is the place where the action is...the commercial diving, offshore construction and oil industry capital of the world.



## BECAUSE

The Ocean Corporation is a commercial diving company, not just a school. Our facilities, equipment and training aids are the best, and our diving systems are as up-to-date as possible... because much of the equipment is used by our diving operations division to perform actual diving contracts in the field. Ocean Corporation has successfully completed many underwater jobs for various industrial clients over the years... including specialized underwater inspections, maintenance and repair work. For example, we did the world's first commercial underwater repair job in a nuclear power plant. And most of our divers have been graduates of our own school.

## BECAUSE

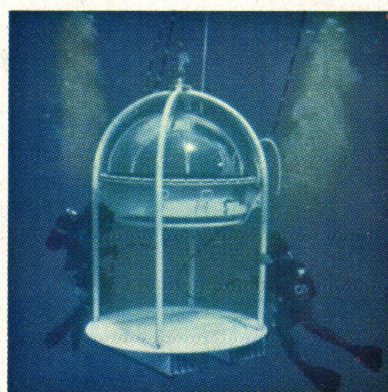
The Ocean Corporation is a convenient and exciting place to go to school. Houston is one of the fastest-growing and most dynamic cities anywhere. It is a city of expansion, energy and youth (the average resident's age is in the mid-20's). Houston offers every conceivable kind of entertainment, from sports events, ultra-modern discos and open-air theater to rough-house local rodeos, chili cook-offs and the new Texas-size



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## BECAUSE

The Ocean Corporation management and instructor staff have long-term experience in the international offshore oilfield diving business. Retired ex-military divers and sport scuba divers don't run the school...commercial divers do. For example, the President of The Ocean Corporation, Larry



Cushman, was Vice President and Europe/Africa Area Manager for Ocean Systems, Inc. for three years...with responsibility for all North Sea diving and underwater construction operations. He also worked six years as a manager for Oceaneering International, Inc., another of the world's largest commercial diving contractors. Ocean Corporation managers and instructors know today's diving business...first-hand, from recent experience.



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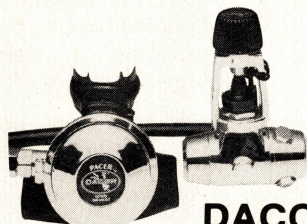
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## Rx FOR DIVERS

(Continued from Page 82)

With scuba, you have to suck to open the second stage valve and blow to push air out through the exhaust ports. That's negative pressure inhalation and positive pressure exhalation. With a well adjusted regulator the effort will be slight. However, it will increase substantially with depth and with exertion because resistance to air flow mounts with increasing density and flow rate. A well designed and adjusted regulator will still perform adequately for sport diving purposes. But many divers ignore regulator maintenance. Maladjustment or fouling with rust or salt can boost inspiratory effort tremendously without affecting expiratory effort. Inhalation will take longer than exhalation and the negative pressure it generates will far exceed the positive pressure that is generated during exhalation. This favors the gradual development of pulmonary edema.

One macho fellow found that his regulator breathed very hard, but he dived anyway. He toughed it out too long. Finally forced to surface, he was too far spent to clear his snorkel, so he set out for shore still on regulator. He didn't make it. Fortunately he was spotted and quickly pulled ashore — unconscious and puffing like a steam engine, in acute pulmonary edema. He recovered.

## LUNG OVER-PRESSURE

Lung over-pressure occurs when the airway is closed while ambient pressure is decreasing. The panicked diver affords the classic example. He holds his breath because he doesn't want to drown and he ascends as fast as possible because he knows there's air up there. But a diver can be perfectly calm and hold his breath without realizing it. I recall making a free ascent with mind engrossed on some now forgotten matter, and becoming aware of a vague chest discomfort. I wondered why, realized I was holding my breath and let it out. I felt immediate relief. Photographers engrossed in tracking a subject may unwittingly hold their breaths while ascending, and buddy breathers are strongly motivated to hold their breaths when not in possession of the regulator. Whatever the reason for breath-holding, we risk lung blow-out.

The upper airway can be blocked in ways other than breath holding. One is swallowing, though that's usually too brief to matter unless ascent is very rapid. Another is vomiting or retching. And still another is laryngospasm set off by vomitus or water hitting the vocal cords. At such times a diver isn't paying much attention to his depth. If he's negatively buoyant, he'll be ascending — and that



could be bad.

It doesn't have to be the upper airway. A blocked lower airway will do nicely. Possible causes include scars, tumors, and cysts. Obstruction can also stem from the edema, mucus and spasms that accompany bronchitis or asthma, or even from a very obese abdomen pushing the diaphragm up and compressing the lower part of the lung.

With lower airways, we're concerned with blockage that's not quite complete. If it were, air wouldn't be able to get into the alveoli. The danger comes from near blockage that slowly admits compressed air during the course of a dive, but won't let it vent out fast enough during the much shorter time of the ascent. The more slowly one ascends the less likely it will be for a partial block to cause tissue rupture.

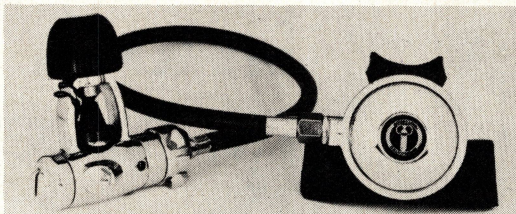
A possible cause of small airway obstruction that's controversial but worth considering is overly zealous exhalation. There's a hydrostatic gradient within the lung itself that favors pooling of blood and tissue fluid in the lower areas and some compression of airways there. Add to this the blood shift caused by diving, and at full exhalation some of those airways collapse completely. This tends to trap air in the alveoli they serve. The question is whether during ascent the over-pressure would build enough to tear alveoli before pushing open the collapsed airway. Even if it would not tear normal alveoli, there remains the chance it might tear abnormal, weak walled alveoli — For example emphysematous sacs that, though unsuspected, are really quite common. Such a mechanism could account for the few cases of embolization that have occurred during free ascent practice when ascent rate was proper and bubbles were seen to issue from the mouth. We believe that instructors should not tell students to actively exhale while ascending. Instead, they should train students to keep their lungs at a comfortable middle value and let the expanding air vent out on its own.

While the usual way to experience a fall in ambient pressure is to ascend through the water, there are other ways. One is to hold onto a fixed line near the surface while large waves pass overhead. If you inhale when the crest of a 15 footer is directly overhead, and neglect to exhale before the trough takes its place, in effect you've made a fast breath-hold ascent. This has caused embolism. Two more ways to blow a lung are to hold your breath during rapid chamber decompression, or to be swallowing in a high flying aircraft when it suddenly loses cabin pressure. This too has been reported.

Anybody's lung will rupture with sufficient provocation, but some are congenitally predisposed. They're born with the basis for emphysema — multiple oversized alveoli or air cysts scattered

(Continued on Page 96)

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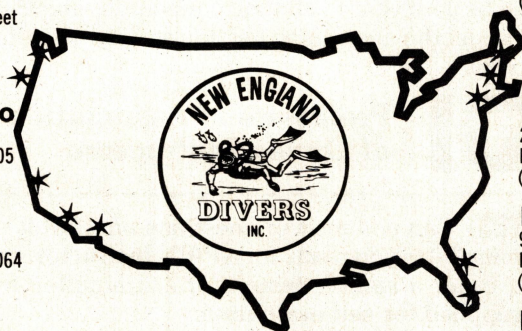
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# Scuba Quiz

## Category: SPG's

By Dennis Graver

In slightly more than a decade the Submersible Pressure Gauge (SPG) has become a widely recognized and recommended item of dive equipment. Its usefulness can be enhanced with a working knowledge. Find out what you know about pressure gauges with this quiz. Answers are on the following page.

**1. A submersible Pressure Gauge is:**

- ☐ A. An optional equipment item
- ☐ B. An essential item for scuba diving
- ☐ C. Mandatory on all dive boats
- ☐ D. Not required by experienced divers

**2. The tank pressure indicated by an SPG is the \_\_\_\_\_.**

- ☐ A. Absolute pressure
- ☐ B. Gauge pressure
- ☐ C. Gauge pressure less ambient pressure
- ☐ D. Gauge pressure less intermediate pressure

**3. Variation in tank pressure due to temperature changes in a standard cylinder is about:**

- ☐ A. Four psi per one degree F change
- ☐ B. One psi per four degrees F change
- ☐ C. One psi per one degree F change
- ☐ D. Ten psi per two degrees F change

**4. After attaching a new SPG to a regulator and attaching the regulator to a tank believed to be filled, you notice the gauge reads only slightly over 100 psi when the valve is opened. The most likely problem is that the:**

- ☐ A. SPG is defective
- ☐ B. Tank is nearly empty
- ☐ C. Reserve valve is incorrectly positioned
- ☐ D. SPG is improperly connected

**5. Which of the following is most likely to occur when the hose of an SPG ruptures:**

- ☐ A. The severed hose will flail furiously
- ☐ B. The hose will hiss loudly and move slightly
- ☐ C. Gauge oil will be sprayed throughout the area
- ☐ D. Air flow will be terminated by the automatic cut-off

**6. While diving you notice that each time you inhale the pressure reading on your SPG drops sharply, then returns to a steady reading. You should suspect that:**

- ☐ A. The SPG is in need of repair
- ☐ B. Your regulator is malfunctioning
- ☐ C. Your tank valve is only partially open
- ☐ D. You are over-breathing your regulator

**7. If a serious leak occurs in the connection between the hose and the SPG while underwater, the diver using the gauge should make:**

- ☐ A. An emergency swimming ascent
- ☐ B. An octopus assisted ascent
- ☐ C. A normal ascent
- ☐ D. An attempt to stop the leak

**8. Water present inside the SPG:**

- ☐ A. Is normal
- ☐ B. Means the gauge has a leak, but may be used temporarily
- ☐ C. Means the gauge has a leak and should not be used before being repaired
- ☐ D. Means water is in your tank and has leaked into the gauge

**9. Which of the following practices with SPG's should be observed by divers?**

- ☐ A. Avoid looking directly at the gauge when opening the tank valve
- ☐ B. Keep the gauge secured so it does not dangle free in use
- ☐ C. Attach a strain relief to the gauge hose where it connects to the regulator
- ☐ D. All of the above

**10. The most significant shortcoming of an SPG is that it is:**

- ☐ A. Expensive
- ☐ B. A passive device
- ☐ C. Inaccurate
- ☐ D. Cumbersome



# Scuba Quiz

## Answers: SPG's

**1. B. An essential item for scuba diving.**

An SPG is as important to a scuba diver as a fuel gauge is to the pilot of an aircraft. The SPG allows a diver to monitor air pressure and maintain a contingency of the supply. When used properly, an SPG can prevent air supply depletion and the associated problems.

**2. B. Gauge pressure.** The SPG reads tank pressure directly and does so with an instrument that has been calibrated to indicate zero pressure at sea level, or one atmosphere of pressure. Gauge pressure does not include atmospheric pressure. Absolute pressure does take atmospheric pressure into consideration.

**3. A. Four psi per one degree F change.** According to Amonton's (not Charles') Law, the pressure of a fixed volume of a gas varies directly with the temperature of the gas. A tank in the trunk of a car at 180 degrees F, if immersed in 60 degree water, would have a pressure difference of about 500 psi with no addition or loss of air.

**4. D. SPG is improperly connected.** There are both high pressure (HP) and low pressure (LP) ports on the first stages of regulators. Attaching the SPG to the low pressure port will result in a reading of the intermediate pressure. Be careful when working with regulators, because damage can occur if the regulator is attached to a high pressure port. It is recommended that SPG installation be done by qualified personnel in a dive store.

**5. B. The hose will hiss loudly and move slightly.** It is common for the high pressure ports on regulators to have restricted orifices. Typically this opening is only about .005 inches in diameter. This small opening prevents rapid depletion of the air supply if the gauge or hose should rupture. Some hoses even have small openings in the fitting where the hose attaches to the regulator. Experiments involving removal of the gauge from the hose do not demonstrate that the hose flails furiously when the air is turned on.

**6. C. Your tank valve is only partially open.** With inadequate air flow and pressure in the first stage of a regulator, it is possible to draw air out of the SPG until pressure can rebuild in the regulator. A valve that is only partially opened will restrict air flow to the regulator during inspiration and is a hazard. Your SPG can indicate the problem if you are alert.

**7. C. A normal ascent.** You may attempt to stop the leak during the ascent, but it is important that the gauge be inspected and repaired before further use. There are two misconceptions regarding gauge leaks that should be clarified: (1) That a leak will rapidly deplete the air supply, and (2) That it is OK to continue diving if a little manipulation stops an SPG leak.

**8. C. Means the gauge has a leak and should not be used before being repaired.** Inside the gauge in a Bourdon tube into which high pressure air is admitted. Water inside the gauge can quickly corrode the tube and a sudden, dangerous leak will result. Don't take chances with a flooded SPG — get it repaired.

**9. D. All of the above.** Gauge faces have blown out and injured divers looking at them, even though a blowout plug is supposed to prevent this. An SPG is a sensitive instrument and should not be allowed to knock about while diving. A strain relief will significantly extend the life of a high pressure hose.

**10. B. A passive device.** An SPG does absolutely no good if it isn't monitored. Divers must develop the habit of checking their own gauges and their buddies' gauges frequently while diving. And the greater the depth, the more frequently the gauges should be checked.

*An SPG is a valuable, essential item of scuba equipment. With proper knowledge, care and use, a gauge can be an asset to an aware diver. You can learn more about the equipment that enables you to go underwater by enrolling in an equipment specialty program. Ask about such a course at your dive store.*

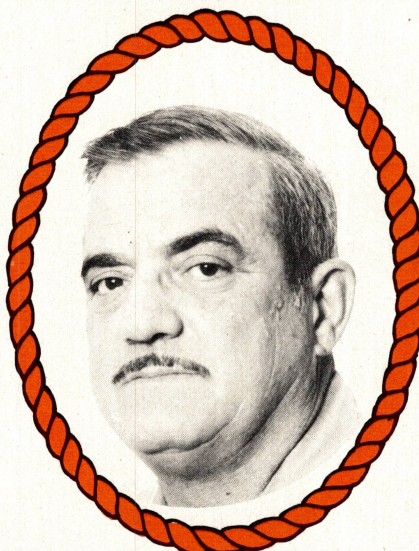


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John W. Manlove — President. Mr. Manlove, a co-founder of the Institute served in the U.S. Navy until his retirement in 1967. He is a graduate of the U.S. Navy Deep Sea Diving School, Washington, D.C., and served as a diver aboard the USS Bryce Canyon, Nereus, Sperry and Klondike. He is experienced in ship repair and salvage, missile and ordnance recovery, underwater welding and cutting, underwater demolition for harbor clearance and diving instruction. Prior to founding the Institute, Mr. Manlove served as Chief Diving Officer-in-Charge of HeO<sub>2</sub> dives at the Underwater Technology Institute and as a free-lance diver in Alaska and Seattle. Mr. Manlove served as Vice President and Director of Training of the Institute for eight years prior to assuming the Presidency in April, 1976. He is a member of the Executive Committee, Institute of Diving, Panama City, Florida and he maintains close liaison with the U.S. Navy, the Association of Diving Contractors, and the Association of Commercial Diving Educators in matters pertaining to commercial diving training. Mr. Manlove was appointed to serve as President of the Association of Commercial Diving Educators in February, 1980.



Robert J. Schnepf — Master Diver/Senior Instructor/Director of Training. Mr. Schnepf served in the U.S. Navy until his retirement in 1971. After graduation from the U.S. Navy Deep Sea Diving School in Washington, D.C. in 1946, he served aboard various Navy salvage ships as tender and diver as well as Master Diver. His experience lies in the fields of ship repair and salvage, underwater welding and cutting, explosives, all phases of mixed gas diving and chamber operation in treatment of diving injuries. Mr. Schnepf assumed his new duties as Director of Training in April, 1976 and he was instrumental in developing the six-month training curriculum for the Institute. He has served as Master Diver and Senior Instructor for the Institute since August, 1971.



John L. Ritter — Instructor/Secretary, Treasurer. Mr. Ritter started his diving career in September, 1967. He is a graduate of the U.S. Navy Second Class Diver's School and the First Class Salvage Diver's School. Upon his separation from the Navy, Mr. Ritter attended the course of instruction at this Institute, graduating in December, 1971. He has had specialized training and experience in HeO<sub>2</sub> diving and manifold operation, salvage, underwater demolition, underwater burning and welding and shallow-water and deep-sea gear. He has been employed with Taylor Diving and Salvage in New Orleans and various commercial diving companies in the local area. In addition, he has completed courses in Industrial First Aid and Chamber Operation as set forth by the Department of Labor & Industries, Division of Safety, State of Washington. He has served as an Instructor at the Institute since January, 1972 and he assumed duties as Secretary/Treasurer in April, 1976.

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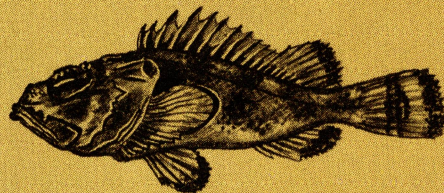


## The Scorpionfish

(*Scorpaena* sp.)

The word scorpion creates an immediate picture of venom and stings. Scorpionfishes are aptly named for their ability to inflict painful, stinging wounds in both fish and man. These fishes have bodies armored with strong, bony spines and often these can be venomous, particularly the spines in the dorsal, anal and ventral fins. Even the scorpionfishes with no venom glands in the spines can cause painful wounds, with infection being the major after effect of contact. Most of the Bahamian scorpionfishes are not venomous, whereas several Indo-Pacific species (such as the *Pterois* lionfishes or *Synanceja* stonefish) are venomous and can cause painful, sometimes even fatal, wounds.

□ All scorpionfishes are bottom dwellers and the diver will rarely see such a fish swimming off the bottom. This is because it lacks the air bladder which regulates buoyancy. The scorpionfish sits on the bottom, making only short, quick dashes either to capture food or escape to shelter. The photographed specimen, opposite, is not in a typical pose; however, since it is shown off the bottom, it is easier to see the physical characteristics of the fish. Scorpionfishes are good camouflagers, with their rough, spiny, blotchy bodies blending into their surroundings almost perfectly. Because of their habit of lying around in rocky areas they are often called rockfishes, particularly off the California coast where they occur in sizeable numbers. □ The characteristic feature of the Scorpaenidae family is the bony plate that extends across the cheek, from beneath the eye to the operculum. This bone is called the suborbital stay and is the reason scorpionfishes are referred to as mail-cheeked. Usually there are spines extending from this bone, which add to the overall spiky appearance of the fish. □ Identification of many scorpionfish species



is difficult unless the fish is speared and examined. The species pictured is from the Caribbean, where identification can be particularly difficult without close observation. In the species *S. plumieri* (the spotted scorpionfish) there is a large black spot underneath the pectoral fin. In mushroom scorpionfish (*S. inermis*) that are well marked, there is a dark blotch above and behind the pectoral fin base. *S. inermis* also has dark margins on the pectoral, ventral, anal and soft dorsal fins, and two dark bars on the caudal fin (Bohlke and Chaplin). Ichthyologist William Eschmeyer of the California Academy of Sciences suspects that the pictured

specimen is *S. inermis*. George Marler, who took the photograph in the British Virgin Islands, reports that he has only seen this fish at night and that the specimen in the picture is small; the largest one he has seen is only three inches long.

*S. inermis* only grows to about 4.5 inches and as an adult has inverted mushroom-shaped figures on the transparent part of the cornea. This fish is found from the Bahamas and Florida, south through the Greater and Lesser Antilles to Curacao, including the islands of the Central American coast. In contrast, *S. plumieri* is a much larger fish, growing to 17 inches and ranging from the Eastern Pacific and Massachusetts to Rio de Janeiro in the Atlantic. It is the largest and most common scorpionfish in the Bahamas. □ There are several hundred species of scorpionfishes found around the world, making it one of the largest of fish families. Those that live in very deep water tend to become quite red overall, and those in shallow water take on lighter, blotchy patterns. The total known depth range for *S. inermis* is from the shoreline to 40 fathoms, but most often it is found in shallow turtlegrass areas, feeding on shrimps, crabs and small fishes. ➤

*Photo By George Marler - Text By Hillary Hauser*

The photograph was taken during a night dive on the wreck of the *Rhone* off Salt Island in the British Virgin Islands. Shot in 60 feet of water with a Nikonos II, 28mm lens, Subsea extension tube, Subsea Mark 150 strobe.







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Medical problems of offshore saturation diving and practical exercises in the diagnosis and treatment of decompression sickness are an essential part of the course.

The academic portion of this course has been approved by the Undersea Medical Society, Inc., and its Education Committee has approved this course for 20 AMA Continuing Medical Education, Category I, Credits.

For further information contact: Dive-Med International, The Gruehn Building, 3001 South Hanover Street, Baltimore, Maryland 21225, (301) 355-1903.

## SEE & SEA TO TRUK, PONAPE

Karl and Jill Wallin of Wallin's Dive Shop will lead See & Sea's March 14-29 dive group to Truk Lagoon and Ponape. As an added feature for underwater photographers, Karl and Jill will bring a supply of E6 chemicals and offer film processing for as long as the chemicals last.

The trip will feature eight days of three tanks per day diving in Truk, the only three-tank program in the region. In Ponape, See & Sea offers the same all-day dive program with lunch at the dive sites.

For further information, contact See & Sea Travel, 680 Beach Street, Suite 340, San Francisco, CA 94109. Telephone (415) 771-0077.

## UES MEDICAL SEMINAR

The Underwater Explorers Society announces a special medical seminar that will be held April 29 and 30, May 1, 2 and 3 at the Freeport, Grand Bahama Island headquarters.

The purpose of the medical seminar is a 10th anniversary reunion marking the beginning of the diving medicine program, first held in the spring of 1971. Since that time, approximately 350 physicians have completed training in basic diving medicine at the Freeport facility and it is these physicians who are urged to return to attend the special post-graduate seminar.

In addition, the Underwater Explorers Society will host a basic diving medicine program April 25 through May 2. This course is open to all physicians who have not had a previous training program in underwater medicine and stresses small class size and individual instruction, particularly in hyperbaric chamber operation and management.

All inquiries about either program

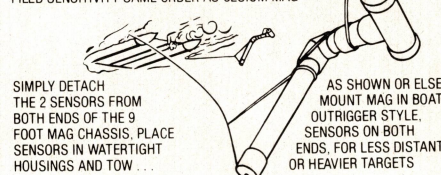
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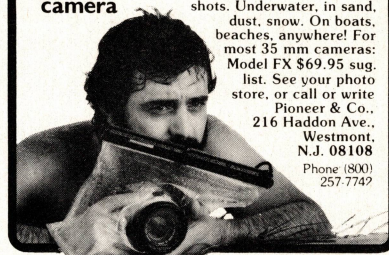


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should be directed to Dr. Edward S. Tucker, Director of Medical Education, Underwater Explorers Society, 64A North Main Street, Essex, Connecticut 06426; (203) 767-1411. 🐟

## UPS COMPETITION

The Northern California Chapter of the Underwater Photographic Society is seeking entries for the 17th Annual International Underwater Photographic Competition being held in conjunction with the annual film festival at the Oakland Paramount Theater, May 2. Categories include movies, slides and both color and black and white prints. There is a separate division for novices.

This year a \$150 cash prize is being awarded for Best of Show in addition to plaques and ribbons in each category and division.

Entries must be submitted and received no later than March 27. For further information and entry forms contact: Underwater Photographic Society, P.O. Box 326, Fairfax, CA 94930, USA, or phone (415) 454-8801. 🐟

## HOLIDAY INN EXPANSION

The Grand Caymanian Holiday Inn, the largest hotel property in the Cayman Islands, has undergone a \$1 million 34 room expansion and refurbishing.

The Grand Caymanian also has a re-decorated lobby, expanded dining facilities and a new beach front bar with nauti-

cal decor. The dive shop, a franchise of Bob Soto Diving Ltd., will also feature expanded services and improved facilities.

Winter packages rates at the Grand Caymanian Holiday Inn are as follows:

Four-day, three-night vacation packages from \$142 to \$172 per person double occupancy, EP only. Eight-day, seven-night vacation packages from \$318 per person double occupancy, EP only. Single, triple and extra night rates are available.

Seven-day, six-night honeymoon packages, \$609 per couple, EP. Extra night rates are available. The honeymoon package includes air-conditioned room, bottle of champagne, admission to the Cayman Turtle Farm, shoppers' discount book and unlimited use of four lighted tennis courts.

Seven-day, six-night diving packages for certified divers only are \$414 per person double occupancy, EP. Extra night room rates are available. The dive package includes accommodations and five two-tank dives. All divers must have certification cards.

For reservations and further information, travel agents may call the Cayman Islands Reservations Service nationwide toll-free at (800) 327-8777; toll-free in Florida at (800) 432-4858 and in Miami at (305) 448-3634; or the Grand Caymanian's sales office in Miami at (305) 592-8175. 🐟

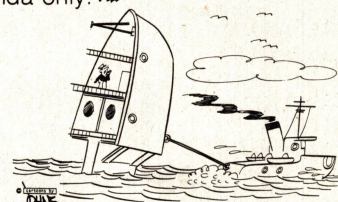
## OCEAN AND REEF SEMINARS

Two seminars on ocean and reef diving will be offered at the John Pennekamp Coral Reef State Park, in Key Largo, Florida, on the weekends of March 6-8 and March 13-15.

The program will include lectures and films on reef formation, marine life, preservation of marine life and ecology, dangerous marine life, waves, currents, entries and egress using different types of boats, procedures, safety, plus the actual experience of diving the different reefs at the Park — Molasses, French, Benwood wreck, the Statue, Elbow, etc. Three two-tank day dives and one night dive are included.

Seminar director is Al Marques, a YMCA and PADI instructor, with 17 years of experience teaching scuba. Al is the scuba instructor and underwater activities program coordinator at Pennekamp.

For further information, telephone: (305) 451-1621, 248-4300 (Miami line) or (800) 432-2871, a toll-free number for Florida only. 🐟



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NEW! Bert Kobayashi, Ph.D. Marine Biology, graduate of Scripps Institute of Oceanography, will teach Bio Marine/Ecology (3 units extension credit, Univ. of California at San Diego).



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## Rx FOR DIVERS

(Continued from Page 87)

throughout their lungs. By physical law, expansion with each ordinary inhalation exerts more stretching force on larger than on smaller air sacs. In time, the walls stretch too thin, and some rupture into adjacent alveoli creating larger sacs. These are still more susceptible to overstretching and the process continues, unknown to the person involved. Finally even a slight stress may provoke a tear that causes a significant air leak. The provocation can be over-pressure during a dive, underwater breath-hold swimming, or just coughing or straining. People known to have emphysema are at high risk of lung blow-out and should not dive.

Dr. Colebatch of Australia has identified what seems to be another group at risk. He ran pulmonary function studies on divers who had sustained pulmonary barotrauma in the past and found that their lung compliance was lower than normal. Compliance is ease of expansion and it's determined largely by the number of elastic fibers. The more of these there are to resist stretch, the lower the compliance. He hypothesized that the barotrauma victims had an unequal distribution of compliance. With lung over-pressure, areas with lots of elastic fibers and low compliance would resist expansion. Areas of high compliance would be overexpanded and rupture.

The mechanism of lung blow-out needs a closer look. It's generally been considered obvious — over-pressure causes over-expansion and rupture. That concept seems adequate to explain tissue tear with small airway blockage, but it's not entirely adequate to explain how upper airway blockage causes blow-out. Normal lungs removed at autopsy can be inflated beyond what is possible within the chest and not rupture. How then can a breath-hold ascent cause rupture? We believe the answer is distortion. Inflated outside the chest, the lungs expand uniformly, like a balloon. But when a diver ascends with his upper airway closed, his lungs can expand uniformly only until the chest wall reaches its limit. With further ascent, they can't expand any more outward, but they can and do continue to expand downward. The non-rigid diaphragm is simply pushed down into the abdomen. Expansion becomes dimensionally disproportionate. The lung's supporting tissues were not designed to resist this kind of distortion, so rupture occurs. Some experimental evidence supports this view. Animals subjected to lung over-pressure are protected by binding their chests to limit expansion; the protection is increased if the abdomen is also bound.

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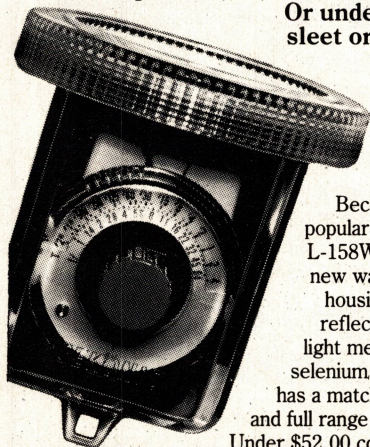
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The consequences of lung over-pressure fall into two main categories. Any over-pressure, whether over-expansion occurs or not, affects the circulation of blood, sometimes profoundly. Over-pressure with over-expansion tears lung tissue. This permits bleeding into the airways, usually mild but occasionally severe. It also permits air to escape from the lungs into the blood vessels, the mediastinum, or the pleural space, producing air embolism, pneumomediastinum, or pneumothorax.

### CIRCULATORY EFFECTS

The commonest cause of significant lung over-pressure in divers is the Valsalva maneuver, used for ear clearing. It consists of blowing with the mouth and nose closed off. This compresses the air within the lungs and raises the pressure within the chest above ambient. The great veins in the chest carry blood from the general circulation back to the heart at low pressure. They become partly collapsed, so the heart doesn't get as much blood to pump. The pulmonary capillaries and veins are also collapsed and resist passage of the little blood that is pumped. As a final insult, the Valsalva causes a reflex slowing of the heart. A strong, prolonged Valsalva can so reduce cardiac output that the brain is starved for oxygen and underwater blackout occurs.

A Valsalva-like effect can be obtained in several other ways. Prolonged coughing or straining with the larynx closed will do it, so will ascending with the airway closed, after maximal chest size is reached. Again, underwater blackout can result.

We will continue our discussion on Lungs Under Pressure in the next issue. The topics covered at that time will be: air embolism, pneumomediastinum, pneumothorax and how to recognize pulmonary barotrauma.

### MERMAID II

*Mermaid II*, and her support vessel, *Aloha*, arrived in New Orleans in August from the Atlantic, and were immediately called on by a major offshore operator for a buoy release job 100 miles off the Texas-Louisiana border in the Gulf of Mexico.

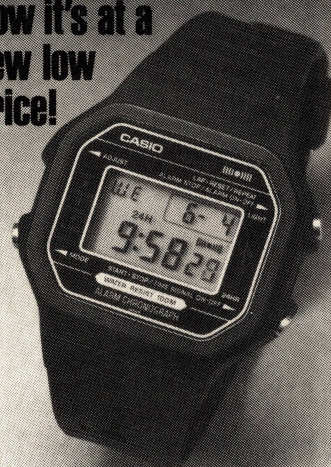
Once on location, the *Mermaid* made 29 hawser cuts, in 220 to 320 feet of water, and several general inspection dives on a 2000 foot long, 12 inch diameter pipe over a three day period.

Because of the tremendous upward force of the buoys which would be exerted in unpredictable directions upon the severing of the lines, their release had been deemed a highly dangerous job to be undertaken by divers.

Upon completion of this project, *Aloha* and *Mermaid* returned to Houston, where the *Aloha* will be outfitted with a new bow thruster and 18 ton hydraulic crane.

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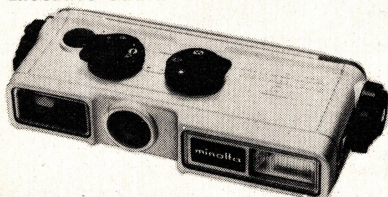
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## SELPAC SOUTHEAST MOVES

Peter Skop, president of Selpac Southeast Corporation, has announced the company's move to a recently completed 12,000 square foot warehouse and office facility in Norcross, Georgia.

The company is regional distributor for Sherwood Selpac, one of the country's largest manufacturers of compressed



gas control equipment. Sherwood's scuba equipment line includes tanks, valves, regulators, backpacks and gauges.

Selpac Southeast's general manager is Gary Hoyt, a resident of Tucker, Georgia. Frank Bryant, president of Bryant Sales Company, heads Selpac Southeast's U.S. sales representative team. His personal service territory is Kentucky, North Carolina, South Carolina, Tennessee and West Virginia. Bob Ledbetter is sales representative for two of the country's most active scuba markets — Florida and Georgia. Skip Bryant is Selpac Southeast's sales representative for Alabama, Arkansas, Louisiana, Mississippi, Oklahoma and Texas and Alan S. Kipping is Selpac Southeast's sales representative for Mexico, Central and South America.

Underwater International is Selpac Southeast's authorized sub-distributor for areas bordered by the Caribbean Seas. Andy Holub is president of this stocking sub-distribution firm. Holub and his associate, Loui Wesenauer, serve the Caribbean from their headquarters in St. Thomas, U.S. Virgin Islands.

## U/W HOCKEY NATIONALS

The 1981 Underwater Society of America-sponsored underwater hockey national tournament will be hosted by the Cen-Cal Diving Council. The championship tournament will take place May 16 and 17, 1981 in the Treasure Island swimming pool on the Naval base island overlooking San Francisco.

Underwater hockey is gaining popularity. For more information on rules of play, history, strategy descriptions, etc., contact: Christopher Todd, Director, Cen-Cal U/W Committee, 700 Congo Street, San Francisco, CA 94131; Tom Miller, Director, National U/W Hockey

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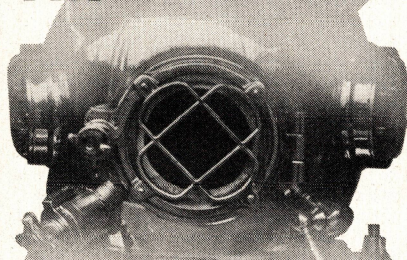
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## BENCHLEY MEETS WINGS

Last August, a film crew converged on the Sea of Cortez hoping to photograph schools of hammerhead sharks for an ABC-TV American Sportsman program. They not only got the shark action but some unique footage of manta rays as well.

It all started when an 18 foot manta was seen swimming near divers. The animal



was entangled in line which cut deeply into its body and had obviously been there quite some time. Stan Waterman's son, Gordy, was instrumental in removing some of the line. Michelle Binder and Marty Snyderman removed the rest. To the film crew's surprise, the animal hung around for about five days, continually positioning itself so that divers could ride on its back. The crew members are convinced the ray thought they were rather large and strange, but effective, cleaner fish.

Among those enjoying an unusual ride were Stan Waterman, Marty Snyderman, Howard Hall, Ted Rulison and (pictured) Peter Benchley, author of *The Deep* and *Island*. Stan Waterman took the photo. »

## NEW PADI CENTER

Ralph D. Erickson, PADI co-founder, has announced the formation of the International PADI Instructor Training Center in Chicago, IL. The center will run year-round, with five weekend courses, ten day courses and complete ten week instructor training programs. All PADI specialty courses will be offered. Instructor candidates will receive dive store operation instruction and sales training. This PADI center will even offer the opportunity to dive some of the world's finest wrecks and will be located at Midway Airport, so private aircraft can be parked nearby. Hotel rooms in every price range are available in the immediate vicinity and there is easy access to Chicago's Loop, shopping and entertainment.

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IMMEDIATE DELIVERY — MONEY BACK GUARANTEE

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breakthrough from . . .

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available at  
this low price

# \$39.95

STAINLESS CASE  
W150C \$4.95



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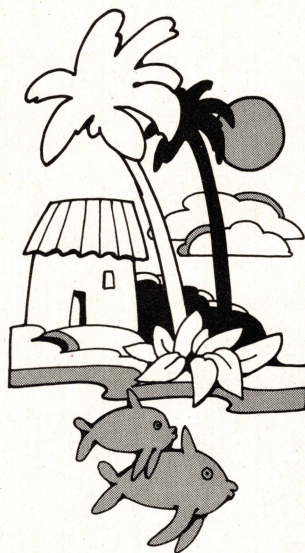
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<b>AQUAVENTURE — 1655 Oakton, Des Plaines, IL</b>		297-7414
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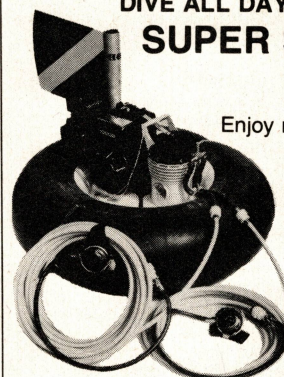
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